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Research and
Education Committee

February 1983

1982 Annual Report on the Food and Agricultural Sciences

From the Secretary of Agriculture to the President and the Congress of the United States

PREFACE

This report was prepared under the auspices of the USDA Research and Education Committee, which was established in 1981 as a unit of the Secretary of Agriculture's Policy and Coordination Council. The Assistant Secretary of Agriculture for Science and Education serves as chairperson of the Committee.

USDA agencies providing assistance in the preparation of this report were: Agricultural Cooperative Service (ACS), Agricultural Marketing Service (AMS), Agricultural Research Service (ARS), Cooperative State Research Service (CSRS), Economic Research Service (ERS), Extension Service (ES), Forest Service (FS), Human Nutrition Information Service (HNIS), National Agricultural Library (NAL), Office of International Cooperation and Development (OICD), Office of Transportation (OT), and Statistical Reporting Service (SRS).

Copies of this report can be obtained from:

Executive Secretary
Research and Education Committee
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14th and Independence Avenue, S.W.
Washington, D.C. 20250

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EXECUTIVE SUMMARY

A major event in 1982 was the appointment of Orville G. Bentley as the first Assistant Secretary of Agriculture for Science and Education with responsibility for a national leadership role in the food and agricultural sciences.

The food and agricultural sciences provide the research and education programs which serve the Nation's largest industry. Agriculture and forestry combined are responsible for approximately 25 percent of both gross national product and employment in the United States.

The first section of this report provides an overview of funding for research and education. In fiscal year (FY) 1982, USDA funds supporting research and education (R&E) programs related to food, agriculture, and forestry totaled $1.2 billion. Other Federal agencies provided an estimated $0.6 billion for agricultural and forestry related R&E. Federal funds expended totaled approximately $1.8 billion for agricultural and forestry related R&E. This represents 4.4 percent of the $38.8 billion expended for all Federal R&D in FY 1982.

Industry and State funding of agricultural and forestry related R&E is estimated at $1.8 billion and $1.3 billion, respectively. Thus, approximately $4.9 billion was expended by all sources in support of research and education in the food and agricultural sciences in FY 1982.

Public and private research organizations have fundamentally different research roles within the broad spectrum of basic, applied, and developmental research. For example, basic research accounted for about 39 percent of all food and agricultural research funded by USDA and the States in FY 1982. The Agricultural Research Service (ARS) had 48 percent of its funds devoted to mission oriented basic research in FY 1982. Industry research in the food and agricultural sciences is approximately 10 percent basic.

By definition, research and education are long range, and year-to-year funding cannot be related directly to the results obtained in any one year. However, in each year, long-term projects, often many years in progress, produce results. Selected examples of major accomplishments by the 12 USDA research and education agencies in FY 1982 are as follows:

- Agricultural Research Service (ARS) scientists transferred a protein storage gene from one plant species to another. This basic research breakthrough in genetic engineering will provide the basis for much future work.

- Early developing calf embryos were split by Colorado State University scientists and successfully implanted in surrogate mother cows to produce genetically identical twin calves. Identical twins are highly valued for research use. This research is partially funded by the Cooperative State Research Service (CSRS).

- The Statistical Reporting Service (SRS) has developed a crop area estimating procedure combining satellite data with ground collected data. This procedure can provide substantially more precise estimates at the State and substate level than the use of ground collected data alone. Procedure costs have been reduced by 60 percent from 1978 to 1982.

- An analysis by the Agricultural Marketing Service revealed that approximately $162.5 million per year could be saved by use of slipsheets rather than pallets for loading groceries onto trailers.

- Lower cost houses are possible because of the recent invention of the Truss-Framed System by the Forest Service (FS).

- Research since 1927 at the Connecticut Agricultural Experiment Station has shown that acid rain has a negligible impact on forested soils.

- The Economic Research Service (ERS) has shown that although strong world demand has developed for high-value (partially or fully processed) farm products (HVP), the United States has been less successful in capturing these markets than have competing exporters. More export promotion activities are recommended for HVP products.

- Opportunities for farmer cooperatives to expand exports through new multi-coop and commodity agreements were evaluated by the Agricultural Cooperative Service (ACS).

- As a result of a project managed by the Office of International Cooperation and Development (OICD) U.S. and Spanish scientists have developed new techniques for producing virus-free fruit tree stock.

- Onfarm demonstrations by State Cooperative Extension Services have shown that solar heating of livestock buildings can be practical.

The second section of this report contains many other examples of major accomplishments and activities of the USDA R&E agencies in 1982.

Recommendations for future directions in the food and agricultural sciences are addressed in section three of this report by several entities including: (1) The United States Department of Agriculture, (2) Joint Council on Food and Agricultural Sciences, (3) National Agricultural Research and Extension Users Advisory Board, and (4) Research and Extension Administrators.

A major recommendation recognizes the need to maintain the pre-eminence of the present Federal-State research and education system in food and agriculture. Additional emphasis should also be given to increasing the supply of fundamental scientific knowledge in the system to meet the unexpected and unforeseeable needs of the future.

Major efforts in long-range planning for research, extension, and teaching programs in the food and agricultural sciences are underway including the following: A long-term needs assessment for food, fiber, and forest products and the research needed to meet these needs was begun. The Agricultural Research Service initiated its most significant strategic planning activity undertaken to date. Plans for basic research and forestry were developed and published cooperatively by the Forest Service, the universities participating in the McIntire-Stennis Program, and the Cooperative State Research Service. A study requested by the National Agricultural Library (NAL) was completed in FY 1982. This study--"An Assessment of the National Agricultural Library"--included detailed recommendations for the future. The Secretary of Agriculture and the President of the National Association of State Universities and Land Grant Colleges jointly appointed a committee to study the future of Cooperative Extension at all levels in the 1980's. The report of this group will be published in FY 1983.

FEDERAL, STATE AND PRIVATE INDUSTRY SUPPORT FOR THE FOOD AND AGRICULTURE SCIENCES

United States Department of Agriculture

The U.S. Department of Agriculture's research and education (R&E) agencies supported food and agriculture research, extension, and teaching programs funded at approximately $1.2 billion in FY 1982, up 4 percent from FY 1981. These programs were centered in the Agricultural Research Service (ARS), Cooperative State Research Service (CSRS), Extension Service (ES), National Agricultural Library (NAL), Forest Service (FS), and Economic Research Service (ERS). Other agencies having research and education activities include the Agricultural Cooperative Service (ACS), Agricultural Marketing Service (AMS), Human Nutrition Information Service (HNIS), Office of International Cooperation and Development (OICD), Office of Transportation (OT), and Statistical Reporting Service (SRS). Table 1 summarizes USDA research and education program funding.

The research and education (R&E) programs of the Department are complementary and mutually supportive in providing new knowledge, technology, and information on food, agriculture, and forestry issues vital to producers, marketing firms, consumers, and action agencies. The results of these efforts affect the total economy of the United States and millions of consumers here and abroad. Including production, processing, and marketing the agriculture and forestry system is responsible for approximately 25 percent of both gross national product and employment in the United States. The system also provided $28 billion in export trade surpluses in FY 1982 which helped to offset huge trade deficits in other categories.

USDA research and education programs address national issues in production efficiency, export markets, marketing efficiency, natural resources management and conservation, human and community development, and human nutrition. Research and education programs financed by the Department encompassing this complex array of issues, represented 3 percent of the FY 1982 Federal R&D budget of $38.8 billion.

The Secretary of Agriculture has identified research and extension as one of his five major goals. The overall USDA research and education programs and activities contribute to each of the remaining goals of the Secretary: (1) a strong, healthy agricultural economy; (2) food and fiber for peace and economic stability; (3) resource conservation; and (4) support for State and local governments.

A major event this year, in the long history of Federal and USDA support for the food and agricultural sciences, was the appointment of Orville G. Bentley as the first Assistant Secretary of Agriculture for Science and Education. Assistant Secretary Bentley was confirmed by the Senate on October 19, 1982 and had served as Acting Assistant Secretary for several months prior to that time.

Provision for an Assistant Secretary for Science and Education was made under Title XIV of the Agriculture and Food Act of 1981.

Table 1 -- Funds for Research and Education

(Budget Authority)

Agency/Item	Fiscal Year 1981	1982	1983 1/
		Thousand dollars	
Research--			
Agricultural Research Service:			
Animal production	76,338	80,144	85,843
Plant production	157,669	167,916	178,854
Soil, air and water	53,743	55,129	62,500
Processing, storage, distribution, food safety and consumer services	83,865	85,567	88,279
Human nutrition	22,668	25,206	26,810
Repair and maintenance of facilities	10,716	10,716	11,092
Contingencies	1,000	1,000	1,000
Subtotal, ARS	405,999	425,678	454,378
Construction of Facilities	12,100	8,596	1,927
Cooperative State Research Service:			
Hatch Act	128,615	141,109	149,295
Cooperative forestry	10,774	12,031	12,452
1890 Colleges and Tuskegee Institute	19,270	21,492	22,394
Special research grants	18,226	23,141	27,775
Competitive research grants	16,000	16,320	17,000
Animal health and disease	6,500	5,760	5,760
Federal Admin. (direct appropriation)	1,512	1,363	290
1890 facilities	- -	- -	10,000
Subtotal, CSRS	200,897	221,216	244,966
Human Nutrition Information Service 2/	8,732	9,203	8,300
Economic Research Service 2/	39,500	39,400	38,900
Statistical Reporting Service 2/	7,500	7,000	7,900
Agricultural Cooperative Service 2/	1,800	1,700	1,700
Agricultural Marketing Service 2/	1,400	1,500	1,500
Office of Transportation 2/	900	900	800
Office of International Cooperation and Development 2/	5,000	731	3,311
Forest Service 2/	108,453	112,100	105,000
Total Research	792,281	828,024	868,682

-- Continued

Table 1 -- Funds for Research and Education

(Budget Authority)

Agency/Item	Fiscal Year 1981	1982	1983 1/
		Thousand dollars	
Education--			
Extension Service:			
Smith-Lever	219,008	233,803	243,643
1890 Colleges and Tuskegee Institute	11,250	12,241	16,241
Expanded Food and Nutrition Education Program (EFNEP)	55,017	60,354	60,354
D.C. Extension	910	983	983
Renewable Resources Extension Act	- -	2,000	2,000
Bankhead-Jones	11,500	- -	- -
Federal Admin. (direct appropriation)	6,084	6,321	5,451
Subtotal, ES	303,769	315,702	328,672
National Agricultural Library	8,121	8,053	9,216
Total, Education	311,890	323,755	337,888
Total, Research and Education	1,104,171	1,151,779	1,206,570

1/ Based on FY 83 appropriations.

2/ Represents only the research-related part of the agency's budget.

Source: Office of Budget and Program Analysis, USDA
December 1982

Other Federally Supported R&E in Food and Agriculture

Federal departments and independent agencies, other than USDA, devoted $581.2 million for domestic programs related to food and agriculture research, extension, and teaching programs in 1981. (While no complete inventory is available for 1982 it is estimated that total funding was approximately the same.) These funds were distributed to major program areas as follows:

Program Area	Research	Extension	Total
	--------Million $-------		
Natural Resources1/	187.4	4.0	191.4
Production and Protection	100.9	19.2	120.1
Processing, Marketing and Distribution	63.1	1.7	64.8
People and Communities	168.0	35.5	203.5
Agricultural Policy	1.4	-	1.4
Total	520.8	60.4	581.2

Departments and agencies supporting these related programs include:

- o Department of Commerce
  - National Oceanic and Atmospheric Administration (NOAA)
  - Science and Technical Research
- o Department of Defense
  - Army Corps of Engineers
  - Research, Development, Testing and Evaluation
- o Department of Education
  - Postsecondary Education
- o Department of Energy
- o Environmental Protection Agency
  - Research and Development
- o Department of Health and Human Services
  - Alcohol, Drug Abuse, and Mental Health Administration
  - Bureau of Foods, FDA
  - Bureau of Veterinary Medicine, FDA
  - Centers for Disease Control
  - Health Resources Administration
  - Health Services Administration
  - National Center for Health Statistics
  - National Institutes of Health

1/ Includes soil and water and forest, range, and wildlife programs.

- Department of Interior
  - Bureau of Land Management
  - Bureau of Mines
  - Bureau of Reclamation
  - Fish and Wildlife Service
  - Geological Survey
  - National Park Service
  - Office of Surface Mining
- International Trade Commission
- Department of Labor
- National Aeronautics and Space Administration
  - Space and Terrestrial Applications
- National Science Foundation
- Tennessee Valley Authority
- Department of Treasury
  - Internal Revenue Service
- Veterans Administration

About 65 percent of the work was conducted through contracts and grants with universities and other institutions. The remaining work was conducted in Federally-owned and operated laboratories. These programs relate to both the action missions of sponsoring agencies and separate science and education missions. A more complete analysis of these activities is available upon request to: Executive Secretary, Joint Council on Food and Agricultural Sciences, Room 351-A Administration Building, United States Department of Agriculture, Washington, D.C. 20250.

State Support

State support for research, extension, and higher education for the food, fiber, and forestry system approximately equals that of the Federal contributions--about $1.3 billion. Combined Federal and State funds support about 11,000 scientists and 17,000 extension personnel who are the formulators and extenders of knowledge needed by the nation's largest industry. Public investment in food and agriculture research and education has consistently provided annual returns of 30 percent or more.

State support for the food and agricultural sciences is provided primarily through the Land-Grant Institutions (1862, 1890, Forestry Schools and Tuskegee Institute) and includes funds for research, extension, and higher education. However, there are an estimated 50 State-supported, non-Land-Grant Institutions that also have agricultural programs. These programs are primarily devoted to higher education.

Private Industry R&D

Estimated industry expenditures for R&D in agriculture and forestry were $1.8 billion in 1979. While no update is available, it is likely that these expenditures did not change greatly over the three-year period. Increases which would normally be expected are likely to have been offset by declines in R&D spending by some agricultural industry firms because of depressed earnings in recent years.

At the farming level, 75 percent of the expenditures are for pesticides, drugs, and farm equipment and machinery--areas of unique concern to suppliers of farm production inputs. At the post-farming level, the emphasis is on food processing, machinery, and packaging. At the time the 1979 report was prepared, directors of several large research laboratories were contacted to determine the type of research undertaken by the private sector. In general, they stated that industry managers had little motivation for expending resources to better understand basic biological and physical processes. They generally depend on public-sponsored research at universities and within USDA for this knowledge. Unless R&D results can be patented and used in a company product in a fairly short time period, private firms are reluctant to finance it.

Basic Research Outlays

In recent years those USDA agencies and cooperating institutions which support and conduct basic research have increased the proportion of their total outlays going into this area (table 2). For example, from FY 1978 to FY 1982 the Forest Service increased the percentage of outlays devoted to basic research from 30 to 35 percent. The Agricultural Research Service increased outlays for basic research from 42 to 48 percent of total research outlays over the same 4-year period.

Overall, the percentage of research funds devoted to basic research by USDA agencies and cooperating institutions was 36 percent in FY 1978. Private industry support for basic agricultural research is estimated to continue at about 10 percent of total outlays.

Table 2--USDA and Cooperating Institutions Outlays for Basic, Applied, and Developmental Research (FY 1982)--With Comparisions

Performing Organization	Basic Research	Applied Research	Developmental Research	Total	Percent Basic1/ FY1982	Percent Basic1/ FY1978
	Million Dollars				Percent	
Agricultural Research Service..	196.0	189.4	26.2	411.6	48	42
Cooperative State Research.....	92.0	129.2	-	221.2	42	NA 2/
Human Nutrition Information Service.....	-	8.6	.6	9.2	-	-
Economic Research Service.....	3.9	35.5	-	39.4	10	NA
Statistical Reporting Service.....	2.3	4.7	-	7.0	33	NA
Agricultural Cooperative Service.....	-	1.7	-	1.7	-	-
Agricultural Marketing Service.....	-	1.2	.3	1.5	-	-
Office of Transportation...	.5	.3	.1	1.9	56	NA
Office of Int'l Cooperation and Development.....	.1	.1	-	.2	50	NA
Forest Service.....	38.7	69.0	4.4	112.1	35	30
Subtotal 3/.....	333.5	439.7	31.6	804.8	41	NA
Cooperating 4/ Institutions.....	276.3	437.6	57.1	771.0	36	NA
Total	609.8	877.3	88.7	1,575.8	39	NA

1/, 2/, 3/, 4/ See page 8.

Footnotes for Table 2

1/ According to the "1975 Survey of U.S. Agriculture Research by Private Industry," conducted by the Agricultural Research Institute, 151 companies indicated that 10 percent of their research was basic.

2/ Not available.

3/ USDA agencies.

4/ Estimated Federal and non-Federal funding at cooperating institutions. Includes SAES, 1890 Colleges, Tuskegee Institute, forestry schools, colleges of veterinary medicine, and other cooperating institutions.

SIGNIFICANT ACTIVITIES AND ACCOMPLISHMENTS IN THE FOOD AND AGRICULTURAL SCIENCES

This section provides examples of significant activities and accomplishments in food and agricultural research and education performed and/or funded by each of 12 USDA agencies. The agency reports contained herein are not intended to be comprehensive, but they will provide an overview of some of the more significant developments during FY 1982.

Agricultural Research Service (ARS)

Significant Activities

- ARS Strategic Planning - In response to General Accounting Office and Office of Technology Assessment recommendations, ARS initiated the most significant strategic planning activity in the agency's history. A framework for long-range planning has been established and implementation plans are underway. The ARS Mission Statement has been revised to better articulate the agency role.

- ARS Research Program Redirection - Major ARS actions are underway to adjust programs and emphasis to changing national concerns. This includes redirection, initiated in 1982, of about 10 percent of agency resources as well as further adjustments resulting from strategic planning.

- ARS Administrative Cost Reductions - Actions to reduce ARS administrative costs by 10 percent are being implemented with released funds going to research programs. Actions include reduction of staff functions, shifting part of administrative reserve funds directly into research programs and administrative efficiencies.

- ARS Award to Recognize Scientific Excellence - To recognize and encourage scientific excellence, a new award was established for ARS scientists that includes a significant cash award as well as additional program support funds. In 1982, the regional winners included Dr. Richard R. Hill, Jr. (Northeast), Dr. James D. Duffus (Western), and Dr. Paul E. Bishop (Southern). Dr. Richard D. Durbin (North Central) received the national ARS Scientist of the Year Award. The regional winners each received a $2,500 cash bonus and $25,000 to support their research program. The national winner received a $5,000 cash bonus and $40,000 to support his research program.

Accomplishments

- Natural Resources - Emphases include efficient use of water, and soil erosion information for solving farm and land use planning problems.

  - A semi-automated gated pipe irrigation system developed in Idaho showed that wheat yields can be increased 17 percent while using about 50 percent less water than with siphon tubes.

- Using a combination of quality water to establish cotton and waste (brackish) drainage water to grow cotton resulted in lower water costs, but reduced yields. The net effect is that cotton production in arid regions may be water efficient and profitable.

- Predicting the critical effects of soil erosion on soil productivity is coming closer to reality through the development of a national model, the Erosion Productivity Impact Calculator (EPIC). This model will assist the Soil Conservation Service in carrying out provisions of the Resource Conservation Act.

- A research-based model was developed to predict appropriate tillage and residue management practices to guide production practices toward high and sustained soil productivity.

o Production and Protection - Progress in plant germplasm and plant and animal pest and disease control results are high on the list of major advances in FY 1982.

- The stock of genetic diversity for many major crops was expanded as the National Germplasm System now contains more than 400,000 crop germplasm accessions in a computerized system. The acquisition of citrus germplasm with resistance to two diseases which costs the U.S. citrus industry over $30 million yearly opens an avenue to reduce these annual losses.

- New wheat germplasm containing genes for resistance to the Hessian fly improves chances for controlling this serious pest.

- A fast-growing nitrogen-fixing bacteria was isolated from a soybean root collected in China and thus opens new opportunities to increase the amount of nitrogen fixed by the plant.

- The first male-sterile, rhizoctonia-resistant sugarbeet germplasm has been released, increasing the potential for improved production efficiency.

- The monoclonal antibody technique is aiding plant and animal scientists in developing more accurate methods that may lead to preventing some bacterial and viral diseases, such as coccidiosis. Also, the feasibility of developing monoclonal antibodies for a wide array of plant viruses has been demonstrated as a step toward control methods.

- Sex-attractant pheromones have been identified and synthesized for five important agricultural pests. Sex pheromone components have been identified that can be used to cause cross mating of cotton bollworms and tobacco budworms with fatal consequences for both insects. The first natural enemy of curly dock weed was found in Italy. New approaches to weed control are being developed through the use of fungus and other plant pathogens.

- In animal disease control efforts, an improved method was developed to detect paratuberculosis in cattle; a test was developed to screen imported cattle and sheep for heart water disease; a vaccine effective in preventing two important swine diseases--pseudorabies and porcine paravovirus was developed; and Marek's disease can be controlled better now by vaccination of the chicken embryo 3 days prior to hatching.

- The Beltville Agricultural Research Center developed two concepts, a Poultry Semen Extender and an improved feeding program. Together they will reduce the need for breeder turkey toms to less than half the number now required.

- ARS scientists succeeded in transferring a gene that directs the production of a major storage protein from its native location in French bean seed into a sunflower cell. This groundwork might well become the foundation for the technology used by geneticists and plant breeders in the 21st century.

o Processing, Marketing, and Distribution - Results supporting U.S. foreign trade and product quality and safety are emphasized.

- An x-ray imaging and chemical sensing system is being developed for Animal and Plant Health Inspection Service to help identify vectors of foreign pests and diseases. The system is already helping to increase the security against fruit fly reinfestation in California.

- A methyl bromide treatment is being developed that may replace ethylene dibromide for some varieties of citrus, strawberries, and cherries. It is effective against fruit flies and codling moth. Japan has approved the treatments proposed for cherries and strawberries, and it is considering approval for grapefruit.

- ARS scientists working cooperatively with commercial companies determined that a continuous microwave tunnel process provides an efficient means for guaranteeing the absence of salmonella in bagged corn-soy-milk blends exported under Title II, P.L. 480 programs.

- Research on the heat inactivation of mycobacteria in pork products has permitted the Food Safety Inspection Service to write new standards for processing meat from swine "passed-for-cooking." Lower processing temperature requirements will make it possible to use more of the carcass in products such as wieners and bolognas, thus saving about $6 million per year.

o Human Nutrition - Examples reflect progress in maintenance of health, food composition, and nutrient requirements.

- ARS scientists have found evidence that fiber-rich diets affect hormonal balance in such a way as to favor calcification of bone and, thus, these can delay or prevent the onset of osteoporosis.

- A multi-element chemical analyzer was developed that can analyze simultaneously as many as 16 mineral and trace elements in one food sample.

- New procedures were developed for determing vitamin K deficiency. The procedures will be valuable in monitoring the vitamin K status of populations at risk and in determining the vitamin K requirement in the elderly.

o Higher Education

- During the past year, the Office of Higher Education has undertaken joint efforts with university and industry cooperators to initiate development of a design and implementation plan for a Food and Agricultural Education Information System (FAEIS). Data proposed for inclusion in FAEIS represent a broad spectrum of attributes of the U.S. higher education system in the food and agricultural sciences and of students/graduates of such programs (such as, enrollment, degrees conferred, faculty, student support, cost of education, employment demand, etc.). FAEIS accomplishments to date include tentative identification of user needs and proposed content, identification of existing data bases for inclusion in FAEIS and of additional data which will need to be collected, and preparation of requisite survey instruments.

- A publication was released entitled, "Graduates of Higher Education in the Food and Agricultural Sciences: Volume III--Sex, Race, and Ethnicity Characteristics of Students and Graduates and of Food and Agricultural Professionals." It provides findings stemming from a national assessment of the extent to which females and minorities constitute students/graduates in the food and agricultural sciences and similarly, employment in food and agricultural scientific and professional occupations. Given the current and projected shortages of food and agricultural expertise, these two segments of the population represent important sources of human capital which should be developed to meet the Nation's future scientific and technical needs.

Cooperative State Research Service (CSRS)

Significant Activities

o 94 Discipline and Program Reviews - CSRS conducted these reviews in the State Agricultural Experiment Station System, 1890 Institutions, and Forestry Schools utilizing peer panels to evaluate research productivity, program direction, and future research opportunities. State Agricultural Experiment Station Administrators, Administrative-Technical Representatives, and 1890 Directors met in a number of regional and national meetings to administer and focus on emerging research needs and direction. In addition, 233 regional-technical committees conducted meetings to coordinate interstate and interregional research on problems of mutual interest.

- o Planning and Administration of Research Facilities Program with the 1890 Institutions and Tuskegee Institute - This new program was authorized in Title XIV of the Agricultural Act of 1981. Funds were included in the Executive Budget and appropriated by the Congress for the first year of a projected 5-year time span. CSRS worked with the institutions in developing plans for commitment of these resources as soon as possible in fiscal year 1983. This $50 million program will help overcome the most serious obstacle in these developing research programs.

- o Basic Research Plans in Forestry - Plans were published through the cooperative efforts of scientists from the Forest Service, the universities participating in the McIntire-Stennis program, and CSRS. Scientists from these cooperating institutions identified those areas of basic research that must be studied to provide the knowledge base required to better manage and utilize the Nation's forest resources.

- o Formation of Program Analysis and Evaluation Group - CSRS formed this group as part of the initiation of program analysis and evaluation functions intended to assist in the vigorous interactions that are required among State institutions and within USDA.

- o Acid Rain Research - In recognition of the importance of the acid rain issue, the State agricultural experiment stations formally made the National Atmospheric Deposition Program an interregional project (IR-7) within the Regional Research Program. The State agricultural experiment stations with CSRS funding and other cooperating Federal, State, and private organizations are operating approximately 100 monitoring sites under this interregional program and developing information for a better understanding of the effects of acid rain on crops, soils, and aquatic systems.

Accomplishments

The State institutions conduct research and experiments on the problems related to the development of a permanent and sustaining system of agriculture and forestry, and in improvement of the economic and social welfare of rural families. The following examples are some of the many research accomplishments being funded at least partially through CSRS-administered funds.

- o Hatch Act Research - The Hatch program of research at the State agricultural experiment stations is aimed at improving rural living conditions, conserving resources, and promoting efficient production, marketing, distribution, and utilization of crops and livestock essential to the food supply or health and welfare of the people of the United States.

    - Nevada Agricultural Experiment Station scientists developed equations that predict mean annual soil temperatures for changes in elevation and displacement northward. These values have broad application and are important to agriculturists, planners, and engineers.

- A heat exchanger constructed by Illinois Agricultural Experiment Station agricultural engineers uses heat from a combine engine to preheat grain in the combine bin for subsequent drying. Temperature rises achieved in corn varied from 6 to 20°C. Savings in energy costs would repay the farmer in about 7 years for the cost of the exchanger.

- Research at the Connecticut Agricultural Experiment Station has shown the impact of acid rain on forested soils to be negligible by comparison with acidity generated by the natural processes of soil formation under forests. Plots established in 1927 show the surface soil of older forests is more acid than forests originating about 1927. Where forests were lost due to infestations of defoliators, the soil surface is now less acid.

- The Ohio Agricultural Experiment Station has released a new semidwarf soybean variety, Hobbit, tailored for yields in excess of 50 bushels per acre. Use of the Hobbit could increase soybean production for domestic and export use by 350-500 million bushels.

- Research at the Arkansas Agricultural Experiment Station has led to the first fungus herbicide introduced by industry. The fungus controls curly indigo, a damaging weed in rice and soybean fields.

- The California Agricultural Experiment Station has discovered beneficial root-colonizing bacteria that protect many crops such as potatoes, sugar beets, radishes, and tomatoes from harmful microorganisms.

- Research conducted at a number of State Agricultural Experiment Stations has led to the discovery, evaluation, and development of a new bacterium, Bacillus Thuringiensis var. israelensis (BTI) effective for the suppression of mosquito and black fly larvae. Three commercial companies are marketing BTI.

- A new soybean leaf disorder, named "soybean leaf scorch," that threatened to disrupt production on 400,000 acres in Georgia has been determined to be related to high levels of chlorine in the soil. The Georgia Agricultural Experiment Station has developed automated methods for detecting chlorine in the soil, and has identified several soybean varieties that are tolerant to chlorine.

- In 1981 bean rust in dry edible beans reduced yields 13-52 percent and totally destroyed some bean fields in North Dakota. The North Dakota Agricultural Experiment Station developed a fungicide treatment that effectively reduces loss to bean rust even after the disease is in the field.

- Colorado Agricultural Experiment Station scientists have developed techniques to split early developing embryos taken from donor cows, place the two halves into one or two recipient cows and produce two genetically identical calves. As embryo-splitting procedures become practical, they will greatly enhance the reproduction of genetically superior animals.

- Avian scientists at the New Hampshire Experiment Station have developed lines of chickens which are nearly 100 percent resistant to the development of tumors when injected with Rous sarcoma, a cancer-inducing virus.

- Obesity may be inherited, according to scientists at Michigan Agricultural Experiment Station. They have demonstrated that the brown adipose tissue in rats tends to conserve dietary energy causing fat to be deposited rather than producing heat, as it does in normal subjects. Sympathetic nervous system activity which is hereditary in at least one animal model is significantly lessened in the brown adipose tissue of individual animals that become obese.

- A bacterial food pathogen of the genus Campylobacter have been found to be a much greater cause of food poisoning than previously thought. Epidemiologists are of the opinion that a large number of the 50 percent of food-borne illness never identified because satisfactory analytical techniques are not available may be caused by Campylobacter bacteria. Scientists at the Wisconsin Agricultural Experiment Station have now developed a sensitive technique for detecting campylobacters in foods. By using this new method, scientists will be able to identify and trace the organism in foods and then develop control measures to increase the safety of our food supply.

- "Success" techniques can be learned by children according to scientists in the Western States who have demonstrated that preschool curricula can be designed to develop the social competencies of rural children which will enhance their success throughout life. The results of the research have been used in a 10-part television series that has been viewed by at least 250,000 parents.

o McIntire-Stennis Research - The Cooperative Forestry Research (McIntire-Stennis) program is planned and directed to provide answers to the complex questions that face forest land managers seeking to produce an adequate supply of timber consistent with the demands for wildlife and recreational opportunities in forests.

- Scientists at Texas A&M have developed a liquid fuel derived from heating pine residues. The process is applicable to other plant products such as pine chips, bark, corncobs, and wheat straw. In the newly developed process, tars similar to crude oil are generated by heating residues. The Texas forest scientists then employ the technology of the petrochemical industry to process the tars into a high octane fuel which is usable without engine modification. The technique is considerably cheaper than other methods of deriving liquid fuel from biomass.

- Forest scientists at Virginia Polytechnic Institute's School of Forest Resources have come up with a computer assisted control system for drying pine boards that drastically reduces losses due to the drying process. By measuring the temperature drop across the load, the procedure provides information on the moisture content of the lumber. Computer controlled kilns save $400,000 per year at a cost of $200,000 for the instrumentation.

- With specific herbicides, Alabama scientists have been able to increase by 9 times the volume of 3-year-old pine seedlings. Release of planted seedlings from competition soon after plantations are established means increased volume throughout the life of the stand and greater returns for the landowner.

- Oregon State University scientists have developed procedures for using skylines to harvest small logs from steep terrain that reduce costs and help prevent environmental damage as contrasted with conventional logging practices.

o Evans Allen Research - This formula funded research program for the 1890 Colleges and Tuskegee Institute was established in the Food and Agriculture Act of 1977. Annual appropriations support continuing agricultural research.

- Researchers at the University of Arkansas at Pine Bluff have found a wide variation in genotypes of sweet potato. This finding offers the possibility of adaptations which may simultaneously lower the production costs, increase the yield per unit area, and improve the quality of the potato.

- An objective quantification of meat tenderness that is rapid, reliable, and reproducible has been developed at Tuskegee Institute. This microscopic procedure is applicable even to live animals through the biopsy of muscle tissue. This development offers significant information for animal breeding programs.

- Some feed grains contain aflatoxins that are potentially carcinogenic. As a result, the Food and Drug Administration has placed rather close tolerances on the amount of such aflatoxins that may be present in the feed grain. Recognizing the large potential losses to farmers, scientists at South Carolina State College have developed a more efficient assay technique for quantifying aflatoxin components and a solvent extraction procedure for removing the potential carcinogens from the feed grain.

o Special Research Grants - The Special Research Grants program concentrates on problems of national interest beyond the emphasis given to these problems in the formula grant programs.

- A fluidized-bed combustor has been developed by engineers at the Ohio Agricultural Experiment Station. This unique prototype furnace will produce energy from agricultural waste and from other organic materials. This combustion mechanism is a highly efficient producer of heat, is adaptable for either homes or various farm buildings, and overcomes the issue of the vast storage space required for combustion units that burn only agricultural waste. The study shows that 58 million gallons of fuel oil could be saved in Ohio by combustion of only 25 percent of the corncobs grown annually in that State.

- Soil erosion control researchers in Idaho, Washington, and Oregon have developed soil management practices that can be adapted at once into Best Management Practices (BMP) to implement activities necessary to achieve clean and useful water in those States. Economic analysis of these BMPs show paybacks over a period of 15 years because of maintained and enhanced soil productivity attained by reducing erosion.

o Competitive Research Grants - The Competitive Research Grants Program funds basic research in selected high-priority areas related to plant production and human nutrition.

- Corn tissue culture scientists at the University of Minnesota have developed methods to initiate rapidly growing corn tissue cultures which undergo somatic embryogenesis. These somatic embryos germinate readily and grow to be normal corn plants. This is the first report of successful regeneration of whole plants in corn tissue culture. The regeneration of whole plants from single cells in culture is an important component in the development of genetic engineering.

- More efficient nitrogen fixation is possible with Rhizobium Japonicam, a bacteria that lives in a symbiotic relationship with plants and reduces nitrogen in the atmosphere to a form that can be utilized by plants. Strains of the bacteria exist that synthesize hydrogenase and reoxidize the hydrogen to recover some energy lost during conservation. A group at Oregon State University has cloned the gene(s) for hydrogenase and transferred the capacity to recycle hydrogen into a mutant which cannot make hydrogenase. Their ultimate goal is to transfer the hydrogenase gene(s) to strains of bacteria which associate with clover and alfalfa.

- Iron supplements in infant formulas may not have sufficient iron in an assimilable form and this is cause for concern. Supplementation of their diets not only requires the availability of a sufficient amount of iron, but also in a form which can be absorbed. Scientists at the University of California have determined that chelates may be superior to an inorganic salt in increasing tissue iron stores. This allows the amount of iron supplement in the diet to be reduced.

- o Animal Health Research - The Health and Disease Research (Section 1433, Public Law 95-113) program is directed to improving the health and productivity of animals and the welfare of producers and consumers of animal products.

  - Georgia scientists have developed a new vaccine to prevent a disease in broilers known as the Pale Bird Syndrome. In Georgia alone, this vaccine will save millions of dollars annually.

  - Missouri and Texas scientists have developed new or improved tests to identify eight different kinds of mycotoxins which may occur in animal feeds and cause depressed growth or illness. Some of these toxins are suspected carcinogens. These new tests will assist in accurate detection and elimination of mycotoxins from feeds.

  - Alaska scientists have developed an effective vaccine to control brucellosis in reindeer. In Alaska, reindeer ranching to provide meat for local consumption and export has a high growth potential.

  - Iowa scientists have found that a widespread intestinal disease of swine, proliferative enteritis, is caused by a bacterium, Campylobacter Sputorum. This important finding now will make possible research in the development of vaccines, diagnostic tests, improved treatments and other methods to prevent or control losses. Intestinal disease in swine costs produces more than $225 million in annual losses. Proliferative enteritis is one of the several important forms of this disease complex.

Human Nutrition Information Service (HNIS)

Significant Activities

- o Activities in HNIS - These activities center around applied research in nutrition, adequacy of diets and food supplies of the U.S. population, as well as the nutritive value of food, and in information collection and dissemination toward the development of knowledge needed to improve the nutritional quality of diets and the general health of the public.

- o Analyses and Publications of the National Food Consumption Survey - All of the 13 preliminary reports from 1977-78 have been published or are in press. An increasing portion of the FY 1982 activities in this area were in methodological research relating to alternative procedures for conducting large-scale dietary surveys.

- o National Nutrition Monitoring System - Plans for the joint implementation with the Department of Health and Human Services (DHHS) of a comprehensive National Nutrition Monitoring System (NNMS) were submitted to Congress. Under the plan, USDA is to conduct a continuing National Survey of Dietary Intakes beginning in FY 1985 and surveys of household food consumption at 10-year intervals beginning in 1987. This is a significant departure from the former approximate 10-year survey cycle and is expected to result in more data of a longitudinal nature.

- o Development and Maintenance of the Nutrient Data Bank and the revision of Agriculture Handbook Number 8 - The work on a total of 23 sections of the Handbook detailing nutrient composition data on foods in the U.S. as well as Hawaii and Alaska progressed. Nutrient data base information, release of provisional tables, and the generation of new food composition data through extramural research constitutes much of the activity in this area.

- o USDA Family Food Plans - The cost of food in the four USDA family food plans is an estimation prepared and used in many ways. It is published in Agricultural Statistics Statistical Abstracts of the United States, and Family Economics Review.

- o Seven Nutrition Education Research Projects - These are projects aimed towards increasing the knowledge of nutrition education needs of different population groups, for analyzing and interpreting food and nutrition research to develop nutrition guidance concepts and techniques. The projects also provide information and technical assistance to public and private sector groups and nutrition professionals. A wide variety of activities including teleconferences, seminars, conferences, and development of publications and audiovisual material were pursued.

Accomplishments

- o Food Consumption of Households - Five final reports were published on Food Consumption of Households; spring 1977, for the United States and four regions (Northeast, North Central, South, and West). Average quantity and money value, and the percentage of households using each of 440 food groups in a week are shown by household, level of urbanization, and money income. All data collected from about 30,000 households are now available on 20 magnetic tapes.

- o Agriculture Handbook - Two revised sections of Agriculture Handbook No. 8, "Composition of Foods--Raw, Processed, Prepared" were published and a third section on pork products prepared. This new information, the reference source of nutrient data information used worldwide, was incorporated into the USDA Nutrient Data Base for Standard Reference.

- o Four Food Plans - The Consumer Nutrition Division completed revision of the four food plans at different cost levels. These are the low, moderate, thrifty and liberal plans. The Thrifty Food Plan is used as the basis for food stamp allotments and, as a result, is of considerable interest to policymakers and legislators. An intensive informational program is conducted through publications and presentations at conferences on the bases and uses of the plans.

- o In Nutrition Guidance and Education Research - Several accomplishments were realized in this area. These included a publication on sodium which received nationwide attention, a national video-teleconference on nutrition research, and intense planning for a nutrition course to be offered by the American Red Cross for the general public in 1983. In addition, the Food and Nutrition Information Staff provided nutrition education materials to many universities, hospitals, public schools, private industry, other governmental agencies, the Extension Service, and individuals.

Significant Activities

- Foreign demand for U.S. Exports - The growth in foreign demand for U.S. products and an increasing dependency on foreign markets have increased the need for economic research on exports and trade. ERS is a major source of economic information on world agricultural production, consumption, and trade, and their impacts on U.S. agriculture. ERS conducts basic research on the underlying factors affecting foreign countries' agricultural production, consumption, trade, and policies related to these areas. ERS also monitors the world agricultural and agricultural trade situation. From this information base, the agency develops the analytical framework that it uses to forecast world agricultural production, consumption, and trade, and to analyze how changes in weather, the macroeconomy, technology, and policies will affect the world food system.

- Economics of Commercial Agriculture - Research is conducted on the organization and performance of agricultural production and marketing; outlook for inputs, commodities, financial conditions, farm income, and food prices; and analysis of public policies and regulations. These contribute to an understanding of the economic condition of farmers and agribusiness, a vision of where changes will occur, and anticipation of the attendant issues and the analytical and data needs to address them. ERS analysts measure, monitor, and analyze performance of the food and agricultural system, its efficiency, effectiveness, resilience to shocks, flexibility to accommodate changing needs, viability, competitiveness, and productivity.

- Land and Water Resources - The major emphases include (a) identifying and quantifying the principal factors that affect the supply and quality of land and water resources, (b) estimating land and water supply potentials and contraints, and (c) assessing the effects of alternative policies and programs. Studies focus on the impacts of alternative policies and farm programs on soil erosion, sedimentation, and water depletion. These evaluations include empirical studies of the resource implications of policies and programs such as those aimed at increased agricultural exports or integrated pest management.

- Rural America - ERS devotes some of its resources to research on economic and social conditions that affect all rural people--people living in the open country, on farms, and in rural towns and cities. Today, 9 out of 10 rural residents are nonfarm people. Current research is aimed at understanding economic and social relationships in rural areas and the causes of problems of public concern.

Accomplishments

o Agricultural Production and Marketing

- Farmers' financial difficulties have become more severe. The farm sector has experienced low farm income, declining real equity values, and high interest rates for 3 consecutive years. As a result, borrowing capacity has eroded significantly for many farmers. Nationwide, one-third of the farm customers of agricultural banks were loaned up to their practical limit as of June 1982. Higher than the previous 2 years, this figure is expected to rise further in 1983.

- Other ERS research has shown that farm real estate values and taxes are changing. Farmland values declined an average of 1 percent in 1981. Much larger decreases than the national average occurred in the Corn Belt. The rate of forced sales and foreclosures has increased. The average tax per acre increased from $3.58 in 1979 to $3.85 in 1980. However, since 1970, the average tax per $100 of full market value declined approximately 54 percent. Some of this decline can be attributed to the increased use of differential assessment laws, circuit breaker tax credits, and legislative limits on the growth of property taxes.

o Exports and trade

- U.S. exports of high-value agriculture products are not up to par with those of bulk commodities. World trade in farm products grew from $50 billion to $230 billion in the past decade. Increased affluence and growth in population generated more growth in demand for bulk commodities such as grains and oilseeds. ERS research also revealed that increased affluence in developed and middle-income countries generated even stronger demand for high-value farm products (HVP). The United States succeeded in capturing almost two-thirds of the expansion in the low-value bulk trade; however, it was less successful in capturing growth in the HVP markets. The result is that the U.S. share of the value of world agricultural exports stagnated. Growth in world demand for HVP is likely to continue fairly strong in the 1980's. More export promotion activities will be needed if the United States is to maintain its competitive edge in bulk exports and improve its position in the HVP market.

o Natural resources and environment

- Benefits of soil erosion control can be demonstrated. Soil erosion is a major problem in the middle portion of the Snake River Basin in Idaho. On more than half of the 1 million acres of irrigated cropland in the study area, soil losses exceed what the natural soil formation process can replace. Application of conservation practices could reduce erosion 1.2 to 1.4 million tons per year and produce net benefits of $10 million annually.

- Foreign ownership of U.S. agricultural land is relatively small. At the end of 1981, foreigners owned or were part owners of 12.7 million acres, or slightly less than 1 percent of all privately owned U.S. agricultural land. Forest land accounted for 56 percent of all foreign-owned acreage. Nationally, the quantity of foreign-owned agricultural land is too small to measure the impacts on agriculture. Research conducted in selected areas indicated that more significant differences in farming practices were found between renter-operators and owner-operators, regardless of residence or nationality of the owner, than between practices used by domestic and foreign owner-operators.

o Rural communities and development

- Farm and rural population trends are diverging. About 5.6 million people lived on U.S. farms in 1982. The lowest number on record, this represents a decline of 14 percent since 1978 when the current farm definition was adopted. ERS analysis of 1980 Census data has shown that, in the last decade, low income, rural, and small-town counties retained or attracted population just about as much as did moderate or high-income areas. In effect, people moving to rural communities in recent years have not been moving to maximize income. Quality-of-life considerations seem to be important. Most rural counties reveal both an increase in the number of older people (65 plus) and an increase in the number of young adults (20-34 years).

Statistical Reporting Service (SRS)

Significant Activities

o Research to Develop Objective Yield Procedures - Research on rice, grain sorghum, and sunflower yields was continued in 1982. This was the second year of study to develop an at-harvest yield estimating capability and to determine appropriate relationships for forecasting in the early season.

o Evaluations of Plant Growth Simulation Models - Initial evaluation of two growth models for wheat were completed and additional research was initiated on two other models to determine the appropriateness of these models for use in the SRS operating program of wheat yield forecasting. These models were developed in cooperation with the Agricultural Research Service and university scientists. As a part of this research, new analytical tools were developed to evaluate the complex functional relationships present in these model types.

- Research on Plant Growth Simulation - Research was initiated with the University of Florida on a plant growth simulation model for soybeans. Also, research was continued to test and evaluate a grain sorghum plant growth simulation model developed through joint research with Texas A&M University. The research emphasis on plant growth simulation models is to develop methods for replacing the present yield forecast system that uses correlative relationships between plant characteristics and yield components with more scientifically based functional relationships directly related to plant growth and development.

- Cooperative Research Project to Develop Remote Sensing Technology - Research on remote sensing for application to irrigated agriculture was initiated in California. In addition to SRS, cooperators in this project included the California Departments of Agriculture and Water Resources, the University of California at Berkeley and the NASA-Ames Research Center. This project is designed to develop methods for using remote sensing data to inventory and monitor agricultural conditions for areas of the world which have significant amounts of irrigation or mix of many different speciality crops, or both. In addition to conventional estimates of crop and/or land use area, this research will explore ways to monitor and/or forecast water use for agricultural purposes through use of aerospace remote sensing data.

Accomplishments

- Procedures Using Both Conventional and Satellite Data - Several procedures using conventional weather data and data from satellites were developed for evaluating growing conditions that may cause substantial yield variations. These are currently being used by the Foreign Agricultural Service in their operational crop condition assessment activities.

- USSR Grain Production Forecasting and Estimating Methods - All methods were examined in a comprehensive study completed in 1982.

- LANDSAT 3 Multispectral Scanner Data - These data were used with SRS ground-gathered data to calculate improved crop area estimated in Kansas, Oklahoma, Colorado, Iowa, and Illinois for 1982. Significant improvements in the methodology underlying this work have been made during the past decade. This is reflected in both the improved estimates and in the cost per State, which has been reduced from $300,000 in 1978 to about $120,000 in 1982.

- Automated Methods - More automated methods of electronically recording field location data from aerial photographs were developed. This will significantly improve productivity for future remote sensing programs.

- Remote Sensing for Studying Land Use - A land use study using aerospace remote sensing data was completed for Kansas. In addition to estimates of area, by use, change monitoring procedures were developed. Results were presented to representatives of 13 other Federal, State and local government agencies in June 1982. Several of these agencies are now studying the utility of the results and procedures developed in this project for use and future implementation into their operating programs.

Agricultural Cooperative Service (ACS)

Significant Activities

- Research and Educational Responsibilities - The Agricultural Cooperative Service (ACS) is assigned both research and educational responsibilities under the Cooperative Marketing Act of 1926 and the Agricultural Marketing Act of 1946. The agency serves as the focal point of national activity involving research and educational programs related to economic, legal, financial, social, organizational, and marketing problems of farmer cooperatives. Research studies conducted by ACS, alone or with other Federal or State institutions, are intended to provide information to assist farmer cooperatives in the development and operation of economically viable, farmer self-help organizations.

- Cooperative Statistics and Educational Materials - ACS serves as the focal point for national and State cooperative statistics and educational materials on cooperative principles and practices as self-help means to increase family farm income. The agency provides materials on many subjects written from elementary to advanced levels. Training sessions are also conducted for directors and managers of new and recently organized farmer cooperatives. Materials are distributed through and programs held in cooperation with various educational organizations including national and State Extension Services, the American Institute of Cooperation, State farmer cooperative councils and committees and others.

Accomplishments

- Pricing Plans for Managing Milk Deliveries by Cooperatives - This study developed a method which enabled dairy cooperatives to recover costs of handling seasonal milk deliveries from producers and the cost of satisfying handlers' cyclical fluid demand. Based on analyses of hauling and manufacturing costs, charges against producers and handlers are formulated. Manufacturing cost is the major component of producer charges.

- Cooperative Involvement and Opportunities in Oilseeds - This study provided a detailed look at the horizontal and vertical structure of the oilseeds complex, including soybeans, cottonseed, and sunflowerseed. The oilseeds processing industry was examined and a framework for cooperative strategic planning was presented. Significant gains in cooperatives' share and volume in the increasingly important export markets were shown. Analysis was completed with a focus on organizational alternatives for improving the efficiency of the cooperatives' oilseed system.

- Coordinating Exports by Farmer Cooperatives - This research evaluates opportunities for farmer cooperatives to expand international trade through multicooperative and multicommodity arrangements. Nine component functions of the export process are discussed, including procurement, processing, physical distribution, market information, sales, finance, documentation, risk management, and regulation. Various organizational alternatives were evaluated; most promising are cooperatives, joint ventures, and Webb-Pomerene associations. Less promising arrangements are trade information services and cooperative brokerage organizations.

- Equity Redemption: Issues and Alternatives - A major report completed the largest ACS combined research and educational project in recent years. The report contains an evaluation of alternative equity redemption plans, methods for adopting them, and legal and tax considerations.

- Petroleum Operations of Farmer Cooperatives - This study showed cooperatives provided more than 40 percent of the petroleum used in farm production in 1979. Many noncooperative suppliers of petroleum are abandoning rural areas and farming communities. Cooperatives refine about 85 percent of the fuels they distribute to farms but purchase more than 90 percent of the crude oil for their refineries. The study points out how vulnerable cooperatives' petroleum systems and the farm and rural markets they serve are to disruptions in crude oil supplies.

- Analysis of Regional Grain Cooperatives, 1980-81 - This study examined the trends in the role of regional cooperatives in originating, transporting, and exporting grain and oilseeds. Total volume net of intercooperative sales, was 3.0 billion bushels in 1980-81, up 24 percent over the past 2 years. Cooperatives accounted for 40 percent of U.S. grain and oilseed export shipments. The largest increases in cooperative exports were in wheat, corn, and soybeans.

- State Incorporation Statutes for Farmer Cooperatives, A Comparative Analysis - The statutory laws of all States and the District of Columbia were researched for statutes available to cooperatives for incorporation. A detailed and comprehensive set of over 300 topics addressed by the various statutes was developed. In a published report, a comparative analysis of 85 statutes for each of the topics, was provided. Results will be used by Federal officials who deal with cooperatives in the 50 States, by attorneys and accountants serving farmer cooperatives, cooperative directors and management personnel, State legislators considering statutory amendment, and other advisors and scholars.

- Statistics on Farmer Cooperatives - For 1981, total business volume for U.S. farmer cooperatives reached a record $71.5 billion, 8 percent above 1980. Cooperative net margins were about $1.4 billion down from $1.9 billion in 1980. The number of cooperatives declined from 6,293 to 6,211, the result of mergers, consolidations, acquisitions, and going out of business. Memberships totaled 5.3 million, down from 5.4 million the previous year, continuing a trend reflecting the declining number of farms and farmers.

Agricultural Marketing Service (AMS)

Significant Activities

- Northeast Beef Study - In cooperation with Cornell University, a study was conducted to evaluate the existing beefpacking industry in the Northeast. The 407 federally-inspected plants within the 9-State area had adequate killing capacity for the 745 million pounds of beef produced annually, but some facilities need updating in both plant design and equipment. It was determined that it would be more economical to encourage the modernization of existing facilities than it would be to encourage construction of new plants to slaughter anticipated increases in supplies of cattle.

- Electronic Marketing - A computer-assisted program for marketing lambs, which originated in Virginia, moved from the project stage to the commercial area. Lambs from over 15 States are now sold through the system. Several other electronic marketing projects were completed with other projects now being evaluated. These include projects on feeder cattle in Texas, hogs in Ohio, and wholesale meat in Illinois.

- Mushroom Industry Analyses - A comprehensive study of the mushroom industry to investigate the competitive stance of domestic mushroom processors with respect to their foreign counterparts was completed and published in 1982. The gross margin and import analyses highlighted the inability of domestic canners to compete with imports under current production and marketing conditions. Expansion of the domestic market per capita demand for fresh mushrooms was deemed to be the most likely achievable alternative for aiding the mushroom industry.

Accomplishments

- Potential Savings with Slipsheets - Savings of more than $45 per trailerload of groceries are possible with the use of slipsheet shipments on a total systems basis. Total savings would be approximately $162.5 million per year. A slipsheet is a thin fibreboard sheet that can be used as a base to unitize the equivalent of a palletload of merchandise for rail and truck shipments. A slipsheet is much lighter than a pallet, requires less cubic space, is less costly, and does not need to be returned, which makes it ideal for the transportation of many food products. While cost savings are realized in the loading and transportation segments, added costs are incurred in unloading by the warehouse receiver. Because of these added costs, $4.12 per trailer, many warehouse receivers refuse to unload slipsheeted products. However, one major manufacturer has announced a program to reimburse warehouse receivers for unloading unitized slipsheeted products in order to benefit from the total systems savings. It is anticipated that others will follow suit.

- o Egg Grading and Packing Plant Expansion - Some firms operate long hours, involving extra shifts per day, in order to grade the volume of eggs required. The feasibility of expanding the capacity of an existing plant to handle the present volume in one shift rather than two was explored. A cost analysis showed that a firm could pay for new highspeed equipment, operate in one shift, and still save about $24,000 per year.

- o Cottage Cheese Whey - Commercial plant systems were developed for recovering a yeast-whey protein material from cottage cheese whey that can be used as a protein enhancer in food preparation. The process substantially reduces the BOD level of the remaining disposable effluent and can be economically justified in plants producing from 73,000 to 137,500 pounds of whey a week.

- o Wholesale Market Facilities

  - In southern New Jersey fieldwork was completed in late FY 1982 in a 10-county area of southern New Jersey to determine the needs for new wholesaling, processing, and distribution facilities to serve the region. Over 700 food firms were included in the study.

  - Analyses of the Raleigh, North Carolina farmers' market and wholesale distribution facility needs were completed and presented to local and State officials. The study determined that there is a need for a new combined wholesale food distribution center and farmers' market to serve central North Carolina.

  - Technical assistance for improving or adding new facilities was provided to Columbia, South Carolina; Atlanta, Georgia; Pittsburgh, Pennsylvania; Boston, Massachusetts; and Lynchburg and Richmond, Virginia.

Office of Transportation (OT)

Significant Activities

- o USDA's Rural Governments Projects - OT is involved in these projects due to the emerging concern over the deteriorating condition of rural roads and bridges. These concerns have been highlighted in studies completed in New York and North Dakota which were monitored by OT. Continuing efforts will focus, in part, on the financial and other economic aspects of rural transportation problems and on the capacity and ability of local governments to deal more effectively with these issues. A meeting on these issues was held with local and state officials and other interested parties in Pennsylvania, and others are being planned in Maryland, Virginia, and West Virginia.

- o Livestock Railroad Car - OT personnel are engaged in the testing of a livestock railcar equipped with onboard feed and water facilities. The objectives of the testing program are to determine the technical and economic feasibility of shipping cattle by rail long distances humanely and safely without unloading every 28 hours for feeding, watering, and resting as required by Public Law 340. Six stationary tests have been conducted at Beltsville with live cattle in a refurbished 90-foot long double-decked cattle car. Actual test shipments began in January 1983 between Tennessee and Amarillo, Texas.

- o International Agreement on Transport of Perishables (ATP) - OT has been actively involved in providing assistance to U.S. congressional committees in the passage of this landmark agreement. One of OT's professionals served as the U.S. representative in drafting of the ATP Agreement. The ATP requires that all transport equipment used to move perishables intercountry (within Europe) be inspected, tested, and certified to specific standards. U.S. ocean-going containers operating in Europe come under the Agreement. Implementation of the ATP has been assigned to the Secretary of Agriculture, with the Office of Transportation representing the Secretary in this activity.

- o Agricultural Logistics Information System (ALIS) - The Office of Transportation is developing this system to serve as a comprehensive tool to provide accurate and timely agricultural transportation data for such users as industry, government, and the academic research community as well as to support the research efforts of OT. A computerized catalog of bibliographic information on transportation and logistics data sources has been completed, and progress is being made on the final phase of the project which consists of providing trends and current data to OT and to other researchers as the needs develop.

Accomplishments

- o Impact of Staggers Rail Act and Motor Carrier Act of 1980 - In August 1982, the Office of Transportation (OT) submitted to the Congress a report assessing the impact on agriculture of these Acts. The report indicated that the effects of the motor Carrier Act have been beneficial and while there are some concerns about the freedoms given to the railroads by the Staggers Rail Act, there have been many positive effects. A followup to this assessment is being implemented by OT to continue monitoring the impacts of these two acts on agricultural shippers.

- o The "Export Handbook for U.S. Agricultural Products" - This handbook was published to serve as a guide primarily to small exporters of agricultural commodities. The 140-page handbook contains information on financing and documentation, as well as technical information on packaging equipment and recommended transport temperatures. Export specifications for 23 agricultural commodities are also included in the handbook.

- o Productivity Measures - A study was made to develop productivity measures for the transportation and warehousing operations of eight regional supply cooperatives. Undertaken at the request of the industry, the study identified a number of financial and physical measurements which could serve as the basis for beginning an industry wide productivity measurement system. A draft report has been reviewed by the cooperators, and a meeting is being arranged for discussions on implementation of a selected number of the measurements.

- o Criteria for Energy Saving Designs in Boxed Beef Shipping Containers - These criteria were developed and published as a result of a 3-year study aimed at finding more energy efficient methods of distributing boxed beef. It was shown that a 48-percent energy saving could result by using a systems approach to selecting the combination of box style and freezing methods for handling beef.

Private Industry Contributions

Private industry has contributed to the Office of Transportation's research program through funding in some instances for travel; providing such services as the loan, installation, and maintenance of equipment; movement of rolling stock; and furnishing products for research. Among these many contributors are the following:

Ortner Freight Car Company
Ralston-Purina
CSX Railroad
Burlington Northern Railroad
Norfolk Southern Railroad
National Cattlemen's Association
American Frozen Food Institute
Lamb Weston
Stouffers Foods, Inc.
Ore-Ida Foods
Pillsbury Company
Bee World
Fruit Growers Express

Office of International Cooperation and Development (OICD)

Significant Activities--Research

- o Bilateral Collaborative Research - OICD in FY 1982 organized a program of collaborative research involving eminent U.S. and foreign agricultural research centers, such as, USDA/ARS laboratories, U.S. agricultural universities, and institutions in Mexico, Australia, West Germany, and New Zealand. In FY 1983 joint projects will begin in Peru, Brazil, Mexico, the Netherlands, and West Germany.

- o U.S.-Israel Binational Agricultural Research and Development Fund (BARD) - BARD was established in October 1977 by the United States and Israel as an independent body governed by a board of three American and three Israeli directors. BARD began operations in 1979 and has funded more than 164 joint U.S.-Israeli research projects.

- Special Foreign Currency (SFC) Research Program - As authorized by the Agricultural Trade, Development, and Assistance Act of 1954, as amended (P.L. 480), USDA uses foreign currencies to support agricultural and forestry research on problems of mutual interest to the United States and participating foreign countries. Since the program began in 1958, USDA has negotiated over 1,800 projects in 32 nations. The SFC program has involved small, targeted research projects that have been commended by participating foreign governments for high levels of accomplishments and increased agricultural productivity.

  During FY 1982 approximately 180 research proposals were reviewed for funding from SFC or U.S.-Yugoslavia Joint Board resources. These proposals were in areas noted as the highest priority by U.S. agriculture research agencies--basic research, plant germplasm collections and evaluation, human nutrition, hardwood forestry management, and forestry plantations for energy utilization. Because of budget limitations in FY 1982, only 25 projects were negotiated and funded, principally in India and Pakistan.

- U.S.-Spain Program of Agricultural Research - The 1976 U.S.-Spain Treaty of Friendship and Cooperation authorized a program of agricultural research cooperation, which OICD manages. Funded by the Department of State, this program will end in March 1983 unless extended by both Governments. A replacement agreement is pending.

  The agricultural program has been funded for 5 cycle years at approximately $1 million per cycle. Research has covered mutual interest areas in irrigation, plant protection, critical crops, fruits and vegetables, animal production and health, forestry, and agricultural economics. New projects will emphasize plant science, animal science, forestry and aquaculture, and the technology of extension and research administration.

- University Linkages - OICD encourages the participation of U.S. colleges and universities in international research activities, as directed by Section 1458 of the Food and Agriculture Act. Since the program's inception in FY 1980, awards have been made to ten U.S. universities and counterpart institutions in Brazil, Nigeria, Columbia, Mexico, and the People's Republic of China, with the aims of (1) initiating consultations in areas of mutual concern, and (2) developing proposals for joint research activities.

Research Accomplishments

- Bilateral Collaborative Research - Pseudorabies work with institutions in Mexico and the University of Missouri is developing and field testing ways to identify latent carriers of the virus, which causes major losses in swine. Basic research on meat properties that influence the manufacture of sausage products and cured meats will involve the University of Georgia and the West German Institution for Meat Research.

- o Special Foreign Currency Research Program - Rice Tungro virus research in India screened 200 rice varieties using a novel technique for reaction to tungro virus, ragged rice stunt, bacterial blight, and rice blast diseases. Resistant varieties developed in the 5-year SFC program are expected to greatly benefit the Cooperative Federal-State rice improvement program, as well as prepare the United States to combat this virus, which is now spreading rapidly throughout Asia.

- o U.S.-Spain Program of Agricultural Research - Virus-free citrus and fruit tree stock has been developed by collaborating U.S. and Spanish scientists, via several tissue culture techniques, including bud-tip grafting, which result in virus-free stock having no juvenile characteristics of vulnerability.

- o University Linkages - Pennsylvania State University and Chinese scientists are researching forecasting and management of peanut leaf spot disease. They have identified strategies for foliar management of the disease with benefit/cost ratios approaching 30 to 1.

Significant Activities and Accomplishments--Scientific and Technical Exchanges

OICD has tried to design exchange activities so that they support USDA's market promotion for U.S. agricultural exports. Some examples are:

- o U.S. Transportation Team's Visit to China - OICD arranged this visit to assess Chinese port facilities vital to U.S. grain shipments. Also, an OICD-coordinated visit by Federal Grain Inspection Service officials resulted in an agreement to facilitate imports of U.S. grains. The Animal and Plant Health Inspection Service (APHIS) is working with OICD on quarantine and inspection requirements which have prevented U.S. livestock sales to the People's Republic of China. China has already bought $375,000 worth of U.S. swine.

- o Testing Procedures for Bluetongue - The presence of the disease bluetongue in the United States has been a nontariff trade barrier against U.S. livestock exports, especially to the European Community (EC). Joint work with Germany will increase EC understanding of U.S. testing procedures, and use of a German serological test in the United States may speed eradication of the disease here.

- o Leather Research - Cooperation with France on leather research has had major economic benefits. The potential export market development is estimated at $10-20 million through new sales of pigskins in Western Europe.

- o Measurement of Food Quality - Hungary is a leader of research on near-infrared measuring of food quality. OICD has coordinated USDA work with Hungary in this field. This technique has potential application in grain sorting and grading, and could be an invaluable tool for U.S. exporters, since it is cheaper and faster than chemical methods.

Significant Activities

- Memorandum of understanding with Canada - The Secretary of Agriculture and the Minister, Environment Canada signed a memorandum of understanding to improve coordination on forestry-related programs between the two countries. Chief of the Forest Service, USDA, and the Deputy Minister, Canadian Forestry Service, signed supplementary memoranda of understanding in August 1982. The memoranda relate to cooperation in the mountain pine beetle program and light frame structures research.

- Research report published - The result of continuing national and regional planning efforts by forestry schools and universities and the U.S. Department of Agriculture, 1980-1990 National Program of Research for Forests and Associated Rangelands, lists current and projected research for improving contributions of U.S. forest and range resources to society.

- Appropriateness of research - At Office of Management and Budget request, the Forest Service analyzed its research programs to identify their appropriateness for conduct by the Federal Government. Duplication of private sector research endeavors was not found. Research areas analyzed were determined to be an appropriate part of a USDA research program. Results of the analysis reinforced agency confidence in the USDA research planning process.

Accomplishments

- Fire and Atmospheric Sciences Research - New mathematical models were developed to determine when to set prescribed fires, based on moisture content in fuels to be burned. National Forests staffs using this system in the Pacific Northwest expect these benefits: elimination of regeneration or erosion failures due to improper burning, reduction in atmospheric emissions of 150,000 tons a year, and yearly cost savings of $2 million.

  - The National Park Service and Bureau of Land Management are currently using satellite mapping techniques developed to survey ground vegetation in relation to prescribed burning. This mapping costs much less than manual inventory methods. A guide to predicting fire behavior on specific sites has been published.

- Forest Insect and Disease Research - The first jointly funded insect research program, the Canada/United States Spruce Budworms Program, has sponsored studies throughout the budworms' range. In the Pacific Northwest, researchers have found that examining annual rings of trees can reveal intensity and duration of budworm attacks in the past, and, ultimately, which site and stand conditions predispose a forest to budworm attack. In the Lake States, a hazard-rating method has been developed to identify vulnerable stands. Hazard rating helps the manager determine appropriate silvicultural practices to "budworm proof" a stand before the insect strikes.

- Pheromone traps--lures that use the sex-attractant scents of female insects--provide a method for estimating numbers of insects in a given location. Such traps are now in use in the South for keeping track of webbing coneworm populations in pine seed orchards. Forest Service research chemically isolated the coneworm's pheromone, permitting it to be synthesized for use in the traps. Trapping data tell managers where to anticipate infestations, where to spray, and where they do not need to spray.

o Renewable Resources Evaluation Research - A joint research effort with the Forest Service and the USDA Economics Research Service has produced data on forest ownership. Knowing these statistics helps the Forest Service motivate landowners to manage their property for tomorrow's timber needs.

- New methodology for conducting mid-cycle timber inventory updates at one-tenth the cost of regular surveys is now available. It inventories changes in a State's timber resource caused by fires, insects, conversion of forest land to agriculture, or timber harvesting.

o Renewable Resource Economics Research - Projections of increased private forest investments using a newly developed model indicate stabilized prices for wood products, reduced timber imports, and increased production in the South after the year 2000.

- Forest Service investigators in the South have been examining the Forestry Incentives Program (FIP) to see if FIP expenditures and numbers of trees planted correlate. Researchers found that when large amounts of assistance were provided, the tree planting rate was relatively high while low FIP grants correlated with low planting rates.

o Surface Environment and Mining - Phosphate spoil dumps are now reclaimable thanks to a 10-year Forest Service project. Analysts determined the best plant species to use in rehabilitating mine spoils and which spoil treatments affect revegetation. The Western phosphate mining industry has adopted FS recommended equipment and techniques, with good results: 75 percent of the desired ground cover in the second growing season.

- A water quality data base developed for the coal fields of Appalachia is now available for regulatory agencies, mine operators, land-use planners, landowners, and environmental groups. It helps users assess the influence of surface mining and reclamation on stream water quality--an important consideration in placing new mines, keeping old ones open, and preventing surface mining where it would compromise downstream water quality.

o Trees and Timber Management Research - A 36-year evaluation of natural regeneration of loblolly and shortleaf pines in the South indicates that all 4 cutting methods studied result in adequate regeneration with lower costs than planting seedlings or direct seeding.

- A computer model was developed that makes it possible to examine the likely consequences of both silvicultural treatments and tussock moth control activities for forest stands in the northern Rocky Mountains. The simulation model is actually a combination of two independently developed models: The Stand Prognosis Model and the Douglas Tussock Moth Outbreak Model.

o Watershed Management Research - FS research on erosion near Mount St. Helens following its eruption revealed that salvaging downed timber lessens erosion, and artifical seeding of grasses does little to stabilize soil before the vegetation becomes well established.

- Using photo-electric particle counters, Rocky Mountain scientists discovered that a third of the snowfall on the high plains of the West evaporates because of high winds. This new knowledge enables engineers to design snow fences and other snow-trapping structures that minimize evaporation and increase the available water.

o Wildlife and Fish Habitat Research - Wildlife biologists published two major books in conjunction with the Department of the Interior and the Wildlife Management Institute. One book covers the biology of 96 species of mammals found along the Oregon coast. The second discusses management of elk.

- Researchers developed a computer model to achieve better management of the more than 5 million acres of land in the West that are covered with aspen. Aspen cover is a step in the natural succession leading to conifer forests. The model simulates changes in ecosystem components over time and anticipates changes in multiple-use values.

o Forest Recreation Research - "Managing" visitors is a delicate art, especially visitors to wilderness areas. To design appropriate regulations, FS staff developed a seven-step system to analyze recreation management issues. This will allow land managers to design regulations that contribute to rewarding experiences for visitors and also protect resources.

- Collecting information about visitor use must be cost effective and unobtrusive enough not to interfere with recreation. Getting visitors to register voluntarily at unstaffed stations has been found as effective as mandatory registration. The less forceful approach probably fits in better with people's ideas of freely enjoying the out of doors.

o Forest Products Utilization Research - Wood preservatives save at least $6 billion a year by extending the life of wood, but these chemicals have been scrutinized by the Environmental Protection Agency (EPA). At EPA's request, the FS Forest Products Laboratory assessed the benefits and exposure hazards of preservatives. EPA is using the resulting report to decide on continued registration for the preservatives.

- The Forest Service's recent invention of the Truss-Framed System for home construction has been made more available to builders through publication of a construction manual. Truss-framed houses cost much less than conventional wood-framed structures and they provide better resistance to storms and earthquakes.

o Forest Engineering Research - Two new computer programs can hold down logging costs: the Preliminary Logging Analysis System (PLANS) and Weak Link. PLANS generates cost-effective, thorough, and rapidly produced timber harvesting plans. Weak Link selects the proper number of machines and workers, determines best operating times for logging systems, and gives production and cost rates for each logging operation. Users report PLANS is the best way to handle timber harvest planning. Weak Link is expected to be popular with logging contractors, forestry schools, and technology transfer specialists.

o International Forestry - The Forestry Support Program (FSP), developed by the Forest Service and the U.S. Agency for International Developemnt (AID), in its second full year of operation, identifies available forestry expertise for the world's major tropical forest areas.

- In the United States/China Science and Technology Programs, U.S. teams on integrated forest pest management, forest genetics, and gypsy moth control visited China this year. The United States hosted three Chinese forestry teams during this period--one on forest fires, one on forest genetics and tree improvement, and a third one on forest inventory techniques.

o Forest Biomass Energy Program - The FS staff prepared training programs for field staff of National Forests and States. The programs go into use early in 1983.

- The Forest Biomass Energy Program participated with the Forest Products Research Society in developing the program and selecting the speakers for the Sixth International Industrial Wood Energy Forum.

Cooperative Extension Service (CES)

Significant Activities

o Integrated Reproductive Management - Work continues on integrated reproductive management to improve livestock and poultry reproductive efficiency through an integrated approach including nutrition, genetics, physiology-endocrinology, environmental controls, management, and other factors affecting reproduction efficiency. IRM goals are to increase reproductive capacity of beef cows for a higher calf crop, shorten calving interval in dairy cows to improve efficiency of milk production, and gain more lambs per ewe per year, more turkey or chicken poults per breeder hen, and more pigs per sow per year. Beef calf losses from weak calf syndrome were reduced for a group of cattle ranches in southeastern Idaho from 20 to 3 percent.

- Agricultural Nonpoint Source Program - A goal in North Carolina is to increase voluntary implementation of best management practices (BMP's) by farmers to minimize nonpoint source pullution into water and improve water quality. About 1,200 people saw a slide show on the problem, including BMP's to prevent it. Increased onfarm manure management during 1981 reduced annual fertilizer costs from $10,000 to $2,000 on some farms.

- Cooperative Educational Forest Management Demonstration Project - Alabama's 21.3 million acres of commercial forestland support the State's largest manufacturing industry -- forest products. Cooperative educational demonstration programs in forest management are sponsored by the Alabama Forestry Planning Committee and involve efforts of 13 agencies. Alabama's Cooperative Extension Service serves as program catalyst. During FY 1982, 13 educational programs or tours were held, each designed to show how to increase productivity, timber yields, income, and other benefits of well-managed forests. Practices started in FY 1982 will lead to doubling of income and growth on the 20,400 demonstration acres.

- Food Economics Taught - Each State designs programs to help consumers understand local food production, delivery, and economics. Florida obtained cooperation from the retail food industry for a series called "Coping with Inflation." Food management programs were shown over cable television and held at community centers, shopping malls, and supermarkets. Computer software was developed to help consumers select best food buys. An interdisciplinary team of Extension, research, and teaching faculty at the University of Florida taught volunteer leaders and Extension home economists and agricultural agents. The course focused on the economics of Florida's food delivery system, its effects on families' food decisions, and the impact of families' decisions on the food system.

- Volunteers Aided Handicapped Adults and Children - In New York, 250 volunteers assisted 90 adult former long-term residents of psychiatric institutes to gain food skills, home maintenance, and safety skills, and socialization and communications skills in their community. In Missouri, 554 volunteers helped with developmental behavior tests and screening of 2,382 children while other service organizations helped screen for vision and hearing defects.

- 4-H Emphasized Life Skills and Production Projects - The 4-H mission is to help youth acquire knowledge and develop life skills. Parents and volunteer leaders organize and conduct educational subject/project experiences in community and family settings. 4-H programs emphasize agriculture (36 percent of projects), home economics (33 percent), and natural resources and community development (16 percent).

- Low-Cost Audio Teleconferencing Proves Effective in Micro-Computer Series - About 175-200 Extension educators from 12 States teleconference regularly with Extension Service (ES), USDA, in a pilot series of audio teleconferences on micro-computers. Topics include: state of the art, office functions, home functions, software, evaluation of systems, and training ideas. Estimated total cost for 14 one-hour audio teleconferences is $3,000-$3,400.

- Satellite Program Facilitated Communications with Textile Industry Leaders - Over 6,000 professionals (educators and store operators) attended a Sewing by Satellite Video-Teleconference sponsored by ES Home Economics and Human Nutrition Unit, the American Home Sewing Association (AHSA), and the American Home Economics Association. AHSA underwrote the conference while Extension textiles and clothing specialists served as facilitators at the 25 U.S. and Canadian sites. Participants received current information on fabrics, design, and small business management.

Accomplishments:

- Solar Heating of Livestock Structures - Solar heating of livestock structures can be practical, according to results of 80 onfarm demonstrations in a 3-year project coordinated by Extension Service-USDA. Objectives of the projects, in nine States, were to (1) demonstrate that solar heating can be practical, (2) test solar energy technology developed under a U.S. Department of Energy/USDA Federal research program, (3) use existing energy conservation techniques (4) test solar energy with minimum of interruption or interference in normal operations of livestock facilities, and (5) identify incentives for widespread farm application of solar energy where appropriate. Solar heating of livestock was found to be a significantly economic alternative to conventional heating; buildings must be insulated before spending money on solar heating; buildings should be as airtight as possible; multiple use of solar systems increases the return; a method to bypass the solar collector should be provided for warm days; collectors should be vented, covered, or shaded in summer for cooling; solar systems should have heat storage capabilities; and a solar system is usually not economically feasible to provide hot water for the dairy milking center.

- Residue Avoidance Program - Extension Service-USDA and USDA's Food Safety and Inspection Service (FSIS) launched a cooperative effort to help livestock and poultry producers avoid violative drug and chemical residues in their slaughtered animals. The Cooperative Extension Services at 31 land-grant universities have developed educational programs aimed at educating farmers on proper animal drug use. Projects include farmer-oriented publications, residue hotlines, animal medication surveys, residue avoidance fact sheets, audiovisual tutorial programs surveys of pesticide practices, and exhibits. Nationally, FSIS has produced slide shows for distribution to States.

- Financial Management Help - The Cooperative Extension Services have produced educational materials aimed at helping U.S. farmers cope with their economic situations. Educational efforts range from personal one-on-one service to programs for mass audiences via live teleconferences. In one State, 700 farmers are interacting on marketing and management problems at 15 locations via Extension closed-circuit television broadcasts. Extension has also developed computer programs specific to farm management. An ES-USDA survey of State Cooperative Extension Services in late 1981 found their programs strong in -- preparation of cashflow projections and development of improved farm organization plans; marketing decisions, including use of futures markets; computer program development and assistance to farmers for financial management; and credit education, working with and through agricultural lenders, especially Farmers Home Administration.

- Master Food Volunteers Extended the Extension System - Over half the States now have Master Gardener or Master Food Preserver programs to add to staffing resources through volunteerism. Extension professionals instruct volunteers 15-30 hours, and the volunteers donate a like number of hours teaching Extension clientele and new audiences. Many volunteers return more hours than required, due to personal satisfaction. Preserving garden produce for later use provides economic return and gives the gardeners a sense of accomplishment and better overall nutrition. Last year, 23 States reported 209,038 participants in food preservation classes. Also, 573 food preservation leaders were trained, and they trained 19,277 preservers and over 200 "Master Preservers."

- Volunteers Extended EFNEP - During FY 1981, 55,000 volunteers helped take the Expanded Food and Nutrition Education Program (EFNEP) to 256,000 homemakers and 575,000 4-H EFNEP youth. Volunteers recruited families and youth, assisted paraprofessionals in teaching about food and nutrition, and motivated families and youth to participate in other Extension programs. EFNEP operates in 1,000 independent sites including cities, counties, and Indian reservations. About 5,500 paraprofessionals aides, helped by the volunteers, teach homemakers and youth to balance diets, select and buy nutritious food, prepare and serve nutritious meals, improve practices in food storage, safety, and sanitation, and manage food-related resources such as food stamps and gardens.

- New Accountability and Evaluation System Introduced - About 300 Extension staff with key program, evaluation, and administration leadership duties throughout the United States and its territories participated in four regional workshops that introduced them to the new Extension accountability and evaluation (A/E) system. The workshops covered the main components of the A/E system -- 4-year plan of work, impact studies, and accomplishment information. Participants learned guidelines to be used to prepare and develop State plans of work and annual reports, including civil rights planning and reporting requirements. State teams attending the workshops are now involving appropriate staff in the State or territory, and they are integrating the new system into local program development.

National Agricultural Library (NAL)

Significant Activities

- International Agriculture - NAL has arranged with the National Technical Information Service for U.S. distribution of the tapes produced by AGRIS, the international bibliographic data base of the United Nation's Food and Agriculture Organization (FAO). The library also is working with the National Library of Medicine (NLM) to include relevant AGRIS records in its TOXLINE data base. AGRIS may be available online in 1983 in the United States through commercial vendors. As the designated U.S. center for FAO bibliographic activity, NAL also sends monthly AGRICOLA tapes to Vienna, Austria for incorporation of U.S. records in the AGRIS data base.

- Electronic Linkage - A pilot project for transmitting cataloging data in electronic form from remote sites into the NAL data base was worked out with Iowa State University, which is recording Extension publications issued in the North Central Region. A project to transmit data electronically to remote users, from Current Awareness Literature searches done at NAL, has been initiated.

- Satellites - A video-teleconference was transmitted live from Denver, Colorado via satellite to the Beltsville library. The library became a receiving station for a special program on marketing information and library services from a meeting of the American Library Association.

- Aquaculture - The development of a national aquaculture information service received substantial assistance from NAL through an interdepartmental committee. In addition to a comprehensive bibliography, several directories--of ongoing research projects, key contacts, and information sources--are in preparation and will be published in FY 1983. A comprehensive, concise overview on aquaculture was published in the Library's Agricultural Issues Series.

- Reference Guide - A major reference work, The Guide to Sources of Agricultural and Biological Research, was made available to scientists, librarians, and writers as the result of a 3-year project sponsored by the National Agricultural Library. A 735-page volume with 5,779 citations covering the last 25 years, the Guide is based on reference collections of numerous research libraries around the world. The new book also includes material on the use of online data base files. The work was issued by the University of California Press, Berkeley in cooperation with NAL.

- Science Symposium - One-hundred thirty scientists, librarians, information specialists, and educators gathered from across the country for a symposium on Twentieth Century Agricultural Science in Washington, D.C. Sponsored by the NAL, the Agricultural History Society, and the Associates NAL, Inc., the symposium featured administrators, historians, researchers, and communications and computer experts. A "computer fair" highlighted data base demonstrations by Extension, Office of Governmental and Public Affairs, and other groups.

FOOD AND AGRICULTURAL SCIENCE PRIORITIES AND DIRECTIONS FOR THE FUTURE

Science by nature is future oriented, involving long time frames over which research and education take place. In food and agriculture the effect of science is also widespread with impacts on not only the entire population of the United States, but also hundreds of millions in other nations.

It is not surprising, therefore, that many entities, organizations, and individuals have made and continue to make recommendations on food and agricultural science priorities and directions for the future. Included in this report are recommendations and reactions from the Department of Agriculture, the Joint Council on Food and Agricultural Sciences, the Agricultural Research and Extension Users Advisory Board, and State and Federal research and extension administrators.

Departmental Objectives

Several of the top 16 USDA objectives for the future, as determined at the Secretary's Top Staff Conference in July 1982, are directly related to the food and agricultural sciences. These include:

- Provide Leadership in Helping Farmers Market Their Products - Research and education agencies will improve the knowledge and information bases available to agricultural producers concerning presently available marketing alternatives; identify opportunities for developing new marketing alternatives; provide information, training, and technical assistance to producers which will improve their marketing skills, practices, and strategies.

- Develop New Agricultural and Forest Crops and Products - Develop a research program that will provide the technology needed to produce new agricultural and forestry crops to meet national needs; provide for crops for arid lands, problem soils, strip-mined areas, and family farms; and develop new crops that will supply new medicinals, gums, waxes, resins, oils, proteins, hydrocarbons and fibers for industrial use and new crops to replace crops in chronic surplus.

- Increase Efficiency in Food, Fiber, and Forest Products Processing, Marketing, and Distribution - Conduct fundamental research on the physical and biological aspects of agricultural and forest products and the processes by which they can be preserved, converted into safe and useful products, and transported from producer to consumer; conduct economic research on costs and efficiency in the marketing system, and the economic performance of markets for agricultural and forest products; and provide for the extension of technology and market intelligence to producers, marketers, and consumers.

Advisory Board Recommendations

The Joint Council (JC) on Food and Agricultural Sciences and the National Agricultural Research and Extension Users Advisory Board (UAB) have prepared recommendations that build upon the significant contributions of the agricultural science and education system. The recommended adjustments are viewed as necessary in maintaining the pre-eminence of this national agricultural system.

The program priorities recommended by both advisory boards reflect a national concern with meeting food and fiber requirements of the 21st century. The increased emphasis now placed upon fundamental science must continue to build to further undergird the unfolding biotechnological revolution. At the same time, our natural resource base must be conserved as the basis for sustaining improvements in production and marketing efficiency. Increasing agricultural exports are recognized as essential to a healthy agricultural economy.

The JC and UAB reports contain a number of specific recommendations outlined in the following sections.

Joint Council Recommendations

The national program priorities established by the Joint Council reflect the different driving forces at local, State, and Federal levels that embody national concerns. The JC formulated one overall national priority and eight specific priorities as follows:

- Maintaining and Improving the Capacity of the Agricultural Research and Education System to Meet the Needs of Users - A broad base of available, continuing research and education expertise must be maintained. It must be protected from inflation and capable of responding to unforeseeable changes in the biological, economic, and social environments in which agricultural production and marketing take place.

- Fundamental Research - Fundamental mission-oriented research must be conducted in the eighties as a basis for applied research of the nineties, which will in turn provide the basis for agricultural production in the 21st century.

- Expertise Development - Agricultural productivity will be restricted in coming years unless declining college enrollments and growing shortages of agricultural scientists and professionals can be slowed.

- Soil, Water, and Forestry Management and Conservation - Integrated soil, water, and production management systems are needed to prevent loss of soil resources, preserve the quality and quantity of water resources, and sustain the production of forest products.

- o Plant, Animal, and Forestry Production Efficiency - Although major advances in productivity have been made in the past 30 years, projections indicate that the rate of productivity growth must increase if adequate food, fiber, and forestry products are to be available in the next century. Increased efficiency of plant and animal production systems can lessen pressure on the natural resource base and reduce production costs.

- o Rapid Information Delivery Systems - Additional computer programs must be developed to facilitate agricultural production and marketing decisions. This technology is needed so producers will have more rapid access to commodity and financial reports and to data banks on crop and livestock control and management.

- o Family Resource Management - The research education base which provides data for family financial management must be expanded to help rural and urban families cope with resource constraints.

- o Factors Affecting Foreign Trade - The physical, biological, cultural, and economic forces constraining exports merit greater attention by researchers and educators. The United States increasingly depends on foreign markets to buy agricultural products and to improve its international balance of payments.

- o Farm Income - Expanded research is needed to identify and predict the effects of alternative agricultural policy decisions on farm income. Policy decisions affecting farm income levels require a thorough understanding of trends in input and commodity prices, domestic and international markets, transportation systems, capital markets, and political forces that influence economic factors.

Users Advisory Board Recommendations

The UAB believes the United States must maintain a pre-eminent national agricultural science system, yet suggests it is no longer possible to sustain all of the publicly supported research and extension programs and facilities conceived in an earlier era. The Board states that a whole range of USDA research and extension programs require a careful assessment to determine if they are efficiently managed and fulfilling priority needs.

The UAB recommends new directions and emphasis as follows:

- o Formula Funding of Science and Education - High priority should continue for formula funding for the State land grant system, however, the formulas for the distribution of Hatch Act and Smith-Lever Acts should be revised to redirect the distribution of funds more in line with the volume of agricultural production. Earmarked Smith-Lever Act funds for Extension should be added to the formula based funds distributed under Smith-Lever Section 3(b) and 3(c).

- o Agricultural Research Service (ARS) - This USDA agency must serve as the fountainhead for sustained intellectual leadership in agricultural research. The Beltsville Agricultural Research Center should be the key national agricultural center--the research associate program should be expanded and--ARS needs to realign more resources to support scientific and technical staffs.

- o The Economic Research Service (ERS) - This USDA agency must take the lead in anticipating problems for U.S. agriculture. The UAB notes the need for increased emphasis in a number of study areas including, price volatility, market pressures, market performance, health of the farm sector, monetary and trade policies and supply/demand analysis to support public policy decisions.

- o Priority Programs - Five priority program areas which must receive adequate financial and staff resources were identified as follows:

  - Macroeconomic analyses of domestic and international agricultural and food policies is essential to aid policy makers in formulating farm legislation.

  - Expansion of agricultural export markets is the most effective means to increase the profitability of American agriculture.

  - In basic agricultural production research, increased use of genetic engineering and bioregulation techniques are needed to improve crop and animal production in the long-term.

  - In postharvest technology research the number of scientist years spent has declined dramatically in the past decade. Research in postharvest technology must be increased.

  - The foundation for a healthy American Agriculture is a rich natural resource base maintained through natural resource conservation. Productivity research must be fully integrated with resource conservation research involving water, soil, forest land, rangeland, germplasm, and acid rain.

Research Administrators Projected Change in Research Emphasis, 1982-1986 2/

During 1981, research administrators in the Federal/State agricultural research system 3/ were asked by the Joint Council to identify changes they would make in the distribution of research resources by 1986 if (1) they had no change in total resources, or (2) received a 20 percent increase in total Scientist-Years (SY's) available for research.

2/ Adapted from "Research Program Adjustments: Historic Trends and Projections to 1986". Joint Council on Food and Agriculture, August 1982.

3/ USDA research agencies (ARS, ERS, FS, ACS, AMS, and OT) and State Agricultural Experiment Stations, Schools of Forestry, 1890 Land Grant Colleges, Tuskegee Institute, and Schools of Veterinary Medicine.

o "Zero Change" Assumption by Research Program (RP) - Projected changes by Research Program (RP) can be viewed in relative terms. Eight research programs, including RP 1.01, Soil and Land Use; RP 3.05, Rice; RP 4.07, Aquatic Food and Feedstuffs; RP 1.02, Water and Watersheds; RP 2.06, Forest, Range, Wildlife and Fisheries Habitat Development; RP 3.16, Bees and Other Pollinating Insects; RP 1.06, Fish and Wildlife; and RP, 3.04, Small Grains Other Than Wheat, would receive increases of 4 percent or more suggesting that these areas are currently understaffed given the significance of the research problems (table 3 and figure 1).

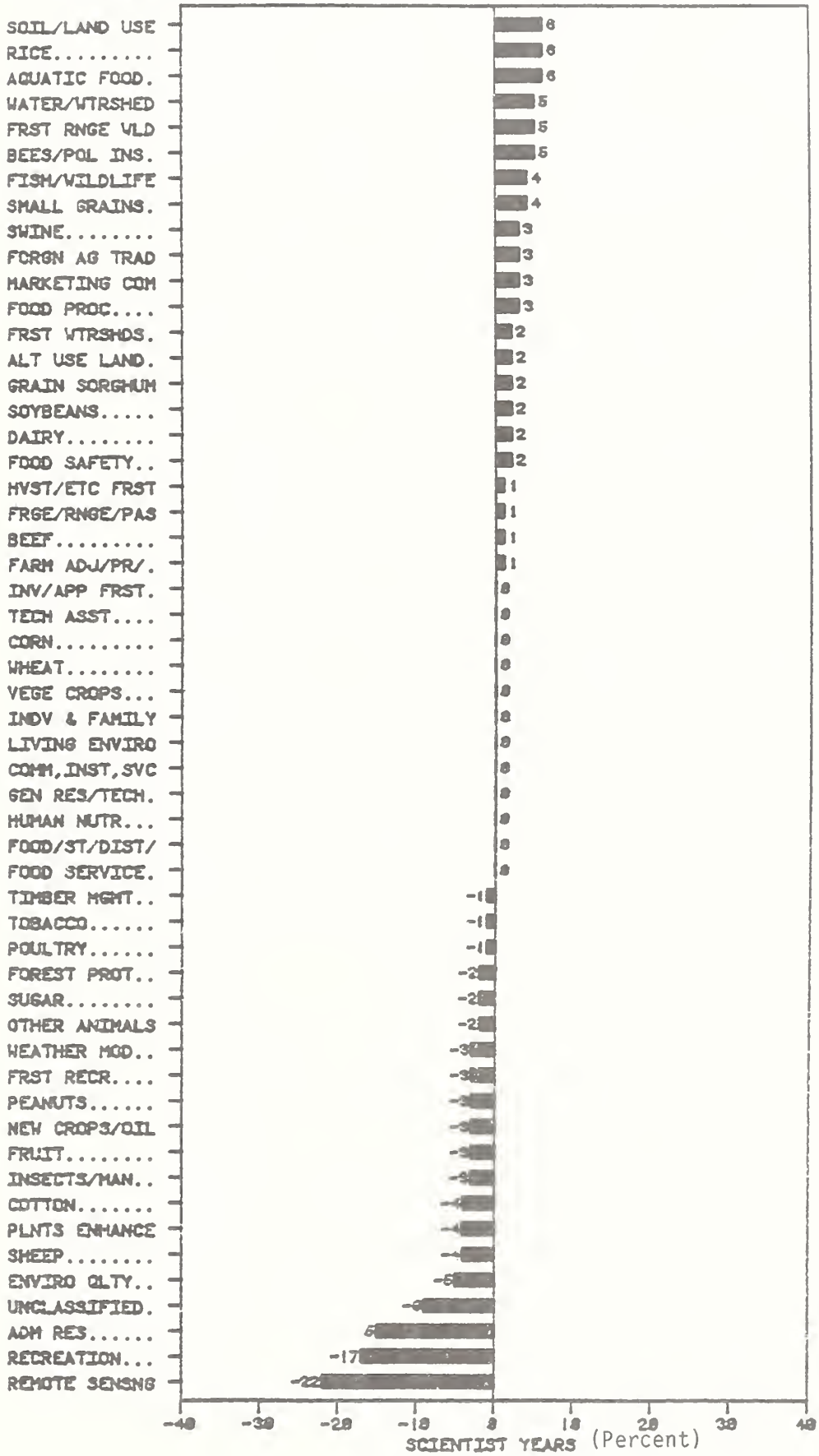
At the other extreme, eight RP's would likely receive reductions of 4 percent or more. These included RP 3.10, Cotton; RP 3.15, Plants to Enhance the Environment; RP 4.04, Sheep; RP 1.04, Environmental Quality; RP 9.01, Unclassified; RP 5.05, Research on Administration of Research; RP 1.03, Recreation; and RP 1.07, Remote Sensing. The inference to be drawn is that these programs have lower priorities, given the other problems that need to be addressed, and assuming no change in overall resources.

Table 3--Highest and Lowest Projected Percentage Change in Scientist-Years (SY's) 1981-1986 by Research Program, Assuming No Increase in Total SY's

	Research Program	Total SY's 1981	Total SY's 1986	Change SY's	Change %
		Number			
1.01	Soil and Land Use	441	468	27	6
3.05	Rice	53	56	3	6
4.07	Aquatic Food and Feedstuffs	67	71	4	6
1.02	Water and Watersheds	293	307	14	5
2.06	Forest, Range, Wildlife and Fisheries Habitat Development	139	146	7	5
3.16	Bees and Other Pollinating Insects	42	44	2	5
1.06	Fish and Wildlife	79	82	3	4
3.04	Small Grains Other Than Wheat	113	118	5	4
3.10	Cotton	321	307	-14	-4
3.15	Plants to Enhance the Environment	247	237	-10	-4
4.04	Sheep	130	125	-5	-4
1.04	Environmental Quality	318	359	-19	-5
9.01	Unclassified	108	98	-10	-9
5.05	Research on Administration and Research	13	11	-2	-15
1.03	Recreation	30	25	-5	-17
1.07	Remote Sensing	45	35	-10	-22

FIGURE 1

PERCENTAGE CHANGE IN SCIENTIST YEARS BY RESEARCH PROGRAM (RP) ASSUMING NO INCREASE IN TOTAL SCIENTIST YEARS, UNITED STATES, 1981-1986



- "20 Percent Increase" Assumption by Research Program (RP) - When administrators evaluated the placement of resources, assuming that their overall resources would be increased by 20 percent, 28 RP's received relative increases of greater than 10 percent indicating a greater relative emphasis, and 10 received increases of more than 30 percent, which suggests a rather dramatic increase in their relative priorities between 1981 and 1986 (figure 2). These 10 include RP 2.09, Technical Assistance; RP 8.02, Food Processing; RP 1.06, Fish and Wildlife; RP 8.04, Food Storage, Distribution, and Marketing; RP 3.05, Rice; RP 4.07, Aquatic Food and Feedstuffs; RP 2.01, Inventory and Appraisal of Forest Resources; RP 2.08, Alternate Uses of Land; RP 4.05, Swine; and RP 8.05, Food Service.

  Twenty-three RP's were projected to increase less than 20 percent, or less than proportional to the average increase. Research programs receiving increases of 10 percent or less included RP 1.03, Recreation; RP 3.11, Tobacco; RP 3.15, Plants to Enhance the Environment; and RP 3.10, Cotton.

- "20 Percent Increase" Assumption by Region - Regional summaries by RPG's, RP's, and RPA's show substantial differences among regional priorities. The differences can be explained in part by the great variety of agricultural production and the geographic specificity of problems related to production of certain crops. They also reflect locations of large Federal laboratories. National summaries of research tend to gloss over or hide the significance of problems that have major importance in specific geographic locations, and shifts in the scientific resource base may be offsetting in the national data.

  When RP's are ranked by percentage change in SY's at the regional and national level, it becomes obvious that changes in relative importance by RP vary substantially and that the national rankings give a very poor summary of regional priorities (table 4). For example, although RP 8.04, Food Storage, Distribution and Marketing, ranked fourth nationally in terms of percentage increase, it ranked eighteenth in the Southern Region and fifteenth in the Western Region. The difference in ranking reflects both the importance of the topic in the region and the division of labor of research activities among regions by agencies and availability of resources.

FIGURE 2

PERCENTAGE CHANGE IN SCIENTIST YEARS BY RESEARCH PROGRAM (RP) ASSUMING A 20% INCREASE IN TOTAL SCIENTIST YEARS, UNITED STATES, 1981-1986

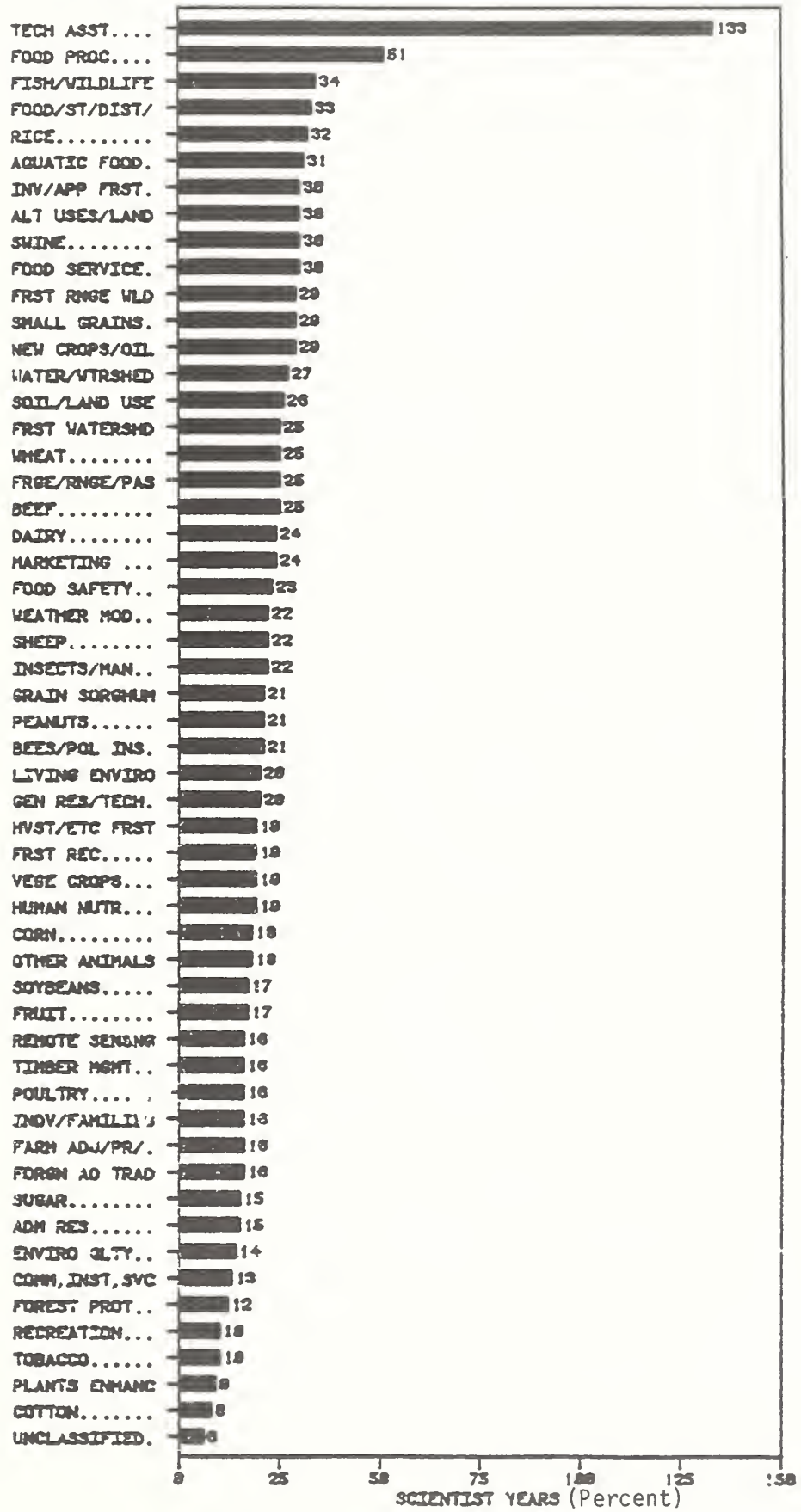


Table 4--Top 10 Research Programs in the United States4/ Ranked by Percentage Increase in Scientist-Years (SY's), 1981-86 with Regional Rankings

Research Program	U.S. SY's	U.S. Rank	Regions: Southern Rank	Northeastern Rank	North Central Rank	Western Rank
2.09 Technical Assistance...	3	1	1	5	4	1
8.02 Food Processing.....	63	2	3	35	6	5
1.06 Fish and Wildlife.....	79	3	6	39	16	23
8.04 Food Storage, Distribution and Marketing..	36	4	18	7	3	15
3.05 Rice.....	53	5	15	3	52	11
4.07 Aquatic Food and Feedstuffs.....	67	6	14	8	5	42
2.01 Inventory and Appraisal of Forest Resources...	92	7	23	19	11	7
2.08 Alternate Uses of Land.	47	8	8	36	22	6
4.05 Swine.....	235	9	16	6	13	38
8.05 Food Service.....	10	10	2	52	9	53

4/ Assuming a 20 percent increase in resources.

Implications

It is probably safe to conclude that, barring increased resources, research administrators do not anticipate significant shifts in research emphasis from 1982-86. With increased resources, significant changes are indicated toward meeting research needs in the areas mentioned by the advisory groups and others. There are many institutional reasons for this slow rate of redirection at relatively constant funding levels in real terms. These include the professional backgrounds of tenured staff which make it difficult to drop one line of research and take up another requiring different disciplines. Also, inadequate or outdated equipment can be a problem under static funding levels.

Projected Cooperative Extension Program Emphasis, 1982 and Beyond

The Extension Service-USDA performs a key role in support of the USDA mission and goals listed earlier. The Smith-Lever Act of 1914 established the Cooperative Extension Service (CES) system as a unique national partnership of Federal, State and local governments. The Federal/State/local partnership is the structural and organizational cornerstone of the system.

The mission statement of the national Cooperative Extension System reads: "The mission of Extension is to improve American agriculture and strengthen American families and communities through informal, research-based education."

The mission statement of Extension Service (ES), USDA, reads: "The mission of the Extension Service, USDA, is to provide national leadership and represent the U.S. Department of Agriculture within the Cooperative Extension system."

o Goals

The goals of the Cooperative Extension system provide continuity and focus for the mission. They are based on the expressed needs of people, legislative mandates, and funding requirements. The goals are listed below:

- To develop efficient agricultural, forest, and rangeland production systems.

- To enhance the processing, marketing, and distribution of high-quality food and fiber for domestic and international consumption.

- To support the conservation and wise use of natural and renewable resources.

- To assist families and individuals to attain knowledge, management skills, and technology necessary to a satisfying and productive quality of living.

- To assist youth in acquiring knowledge, developing life skills, and forming attitudes that will enable them to become self-directing, productive, and contributing members of society.

- To strengthen the capacity of State and local governments to deal with public issues and problems.

- To cooperate with agencies and institutions of Federal, State, and local government and the private sector in developing and conducting informal education and technology transfer programs.

- To cooperate and work with national and international institutions and other persons throughout the world in using the Cooperative Extension Services' concept of informal education.

o High-Priority Program Issues - Nine high-priority program issues for the Extension Service partners have been identified within the above goals for FY 1983 and beyond. These are an integral part of Extension programs at National, State, and local levels and are:

- Crop and Animal Production Efficiency.

- Financial Management.

- Food and Fiber Marketing Management.

- Forest and Rangeland Management.

- Management and Conservation of Soil and Water Resources.

- Human Nutrition and Health.

- Leadership Development for Adults and Youth.

- Local Government Operations and Finance.

- Small Business Development and Management.

Implications

Cooperative Extension Service priority program issues tend to relate closely to a number of the recommendations made by advisory groups and the science and education related objectives of the Department. However, as in the case of the research administrators projections, a "tight" correlation is not apparent. The reasons for this include the fact that not all the entities and organizations which have a stake in the functioning of the Federal-State research and education system are represented in this report. For example, State and local governments, which fund the system on an approximately equal basis (in total) with the Federal Government are not directly represented in any of the advisory or executive groups mentioned in this report. This multiplicity of "guiding entities" is not a recent phenomenon, but has existed essentially from the beginning of the food and agricultural research and education "system" approximately 100-120 years ago.